

BULLETIN No. 26

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October, 1931

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Locomotive Pictures

In BULLETIN No. 25 we listed the plates held by this Society and since that time many of our members have availed themselves of the opportunity of receiving prints from these plates. Since the appearance of Bulletin No. 25, the Society has acquired the following negatives:

Size 4 x 5

- # 1 New York Ontario & Western # 107, 2-6-0, Rome, 1889.
- 2 Pennsylvania Lines # 10233, 4-4-0, D-8-A, Altoona Shops 1887.

Size 3 1/4 x 5 1/2

- # 1 Union Pacific # 1552, 4-6-0, from Oregon Short Line.
- 2 Denver & Rio Grande # 790, 4-6-0, T-29, Brooks 1909.
- 3 Seaboard Air Line # 1589, 4-6-0, Richmond, 1900.
- 4 Cincinnati, Indianapolis & Western # 156, 4-4-0, Pittsburgh 1899.
- 5 Delaware & Hudson Co. # 801, 2-8-0, E-41, Schenectady 1902.
- 6 Delaware & Hudson Co. # 552, 4-6-0, D-31, Schenectady 1907.
- 7 New York Central Lines (L E & W) # 4164, 4-4-0, Schenectady, 1892.
- 8 New York Central Lines (C. N.) # 7034, 4-4-0, Brooks, 1883.
- 9 New York Central # 2554, L-1-B, 4-8-2, Schenectady, 1918.
- 10 Rutland R. R. # 45, 4-6-0, F-12, Manchester, 1902.
- 11 Rutland R. R. # 54, 4-6-0, F-11-A, Schenectady, 1902.
- 12 Rutland R. R. # 80, 4-4-0, C-2, Brooks, 1897, from A & St. L.

Size 3 1/4 x 4 1/4

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|---|---|--------------------|
| # | 1 Dela. Lackawanna & West. # 1011, 4-6-0, H-2-B, | Schenectady, 1905. |
| | 2 Dela. Lackawanna & West. # 1178, 4-6-2, N-7, | Schenectady, 1916. |
| | 3 Dela. Lackawanna & West. # 1502, 4-8-4, Q-1, | Brooks, 1927. |
| | 4 Dela. Lackawanna & West. # 1403, 4-8-2, P-1, | Brooks, 1924. |
| | 5 Dela. Lackawanna & West. # 15, 0-6-0, B-1, | Dickson, 1901. |
| | 6 Dela. Lackawanna & West. # 1138, 4-6-2, N-12A, | Schenectady, 1923. |
| | 7 Dela. Lackawanna & West. # 1103, 4-6-2, N-1, | Schenectady, 1912. |
| | 8 Dela. Lackawanna & West. # 1036, 4-6-0, H-7-A, | Schenectady, 1910. |
| | 9 Dela. Lackawanna & West. # 541, 2-6-0, E-10-A, | Schenectady, 1909. |
| | 10 Dela. Lackawanna & West. # 1236, 2-8-2, L-3-A, | Schenectady, 1916. |
| | 11 Dela. Lackawanna & West. # 2215, 4-8-2, P-4-B, | Schenectady, 1926. |
| | 12 Dela. Lackawanna & West. # 142, 0-6-0, B-12, | Schenectady, 1910. |
| | 13 Dela. Lackawanna & West. # 786, 2-8-0, F-16, | Schenectady, 1908. |
| | 14 Dela. Lackawanna & West. # 199, 0-8-0, C-4, | Schenectady, 1910. |
| | 15 Dela. Lackawanna & West. # 879, 2-8-0, F-7, | Dickson, 1901. |
| | 16 Dela. Lackawanna & West. # 388, 2-8-0, F-19B, | Schenectady, 1911. |
| | 17 Dela. Lackawanna & West. # 1603, 4-8-4, Q-2, | Schenectady, 1929. |
| | 18 Dela. Lackawanna & West. # 2122, 2-8-2, L-6, | Schenectady, 1922. |
| | 19 Dela. Lackawanna & West. # 152, 0-8-0, C-1, | Dickson, 1906. |
| | 20 Dela. Lackawanna & West. # 3501, Oil-electric | G E - I R |
| | 21 Dela. Lackawanna & West. # 180, 0-8-0, C-8, | D L & W 1917. |

The price of the 4x5 prints is 15c to our members and 20c to non-members. The 3 1/4x5 1/2 and 3 1/4x4 1/4 are 10c to our members and 15c to non-members. Specify the negative number, the size and the subject when you order from these negatives. All orders, accompanied by check or M. O. should be addressed to Mr. John W. Merrill, 40 Broad Street, Boston, Mass.

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GAIN we are presenting our members with another bulletin containing a variety of subjects which we hope will be to their liking. There are two new contributors and we hope that their contributions will be acceptable to our members. The first of these is Herr F. Gaiser. The "Notes" that this gentleman has forwarded for publication from Germany show great care in preparation and a wide study of books and journals on his part. Here we have a very careful review on the subject of the very earliest locomotives. Herr Gaiser has indicated a willingness to continue these articles if our members are sufficiently interested in them. We are willing to give them space in our bulletins, but whether you wish them continued or not rests with our members.

Another new contributor is Mr. Sidney Withington, Electrical Engineer of the New York, New Haven & Hartford R. R. To many of our members it may be a surprise and a disappointment to see so much space and so many illustrations devoted to the electric locomotive. Yet the electric locomotive had to be developed, the same as the steam engine, and the New Haven was one of the pioneers in this field. Most of us in this vicinity, not only remember but have ridden on those big open cars on the Nantasket Beach with their big clanging gongs of polished brass that seemed to be about three feet in diameter, yet this was the first instance of electric traction being applied to a steam road in this country. Mr. Withington has contributed a very interesting article in a non-technical manner and on a subject about which he is well qualified to write. Let us hope our members will enjoy this contribution and forgive us for our departure from the "Iron Horse."

For some time it has been the thought of the Editor to reproduce in our Bulletin a list of locomotives of the Boston & Maine R. R. and its subsidiary roads as compiled by the late Herbert P. Yeaton, a former

member of this Society. The amount of research work involved in preparing this list was stupendous. Since this list appeared the early reports of certain of these roads to which Mr. Yeaton did not have access are now in the Baker Library. They fill in some of the blanks and correct Mr. Yeaton's list. The Boston & Maine system now includes some of the earliest roads in New England and for this reason and also out of respect for the work done by Mr. Yeaton, this work will appear in sections in our future bulletins.

To some of our members residing in the west and the middle west, they may feel that the exhibition maintained by this Society in the Baker Library is too far away to be of great interest to them and also they dislike to see local material sent so far away from their own immediate vicinity. It is true that during the last few years that many of our own members residing as far west as the Pacific Coast have visited our exhibition and have felt that they were repaid. Right in this section visitors come daily to see what we have and many of the old time railroad men are glad that this Society started the idea and appreciate the kindness of the authorities of Harvard University for these quarters. Now from the mid-west comes an invitation which our members cannot help but be interested in. The University of Michigan is willing to hold and display in the Transportation Library such material as our members may care to turn over to them. Our relations with Professor Worley, Curator, have been only of the most pleasant. We have been the means of preserving and sending to Ann Arbor material originating in that section and now is the chance for the individual members of that section to help that exhibit out if they wish. It is not the purpose of this Society to draw all items of interest throughout the country to the Baker Library. We simply want them preserved in some safe place and we will do all we can to help.

Oldest Railroad in United States to be Abandoned

Under this caption, the newspapers announced on Aug. 3rd that the Interstate Commerce Commission had granted the application of the Delaware & Hudson Company to abandon the branch between Carbondale and Honesdale Jet.

Originally built in 1828 to transport anthracite coal from Carbondale mines to the Honesdale Terminal of the D. & H. canal, this road has been in operation for over one hundred years. On this line was tried the "Stourbridge Lion", the first steam locomotive in this country when it made its first and only trip over the ten mile stretch between Moosic Mountain and Carbondale. The coal traffic for which this road was built to handle long ago moved via other routes. Passenger operation was discontinued in 1928 and what little traffic now remains is a burden upon the Delaware & Hudson Co. Hence the abandonment of this line has been granted by the Interstate Commerce Commission. Thus passes one of the oldest lines in America.

Affairs of the Society

At a meeting of the Directors of this Society, held in the Baker Library, October 4th, with Messrs. Fisher, Hungerford, Eaton, Becker, Jacobs, Merrill, Fogg and Withington present, it was voted to adopt the following membership fees, effective January 1st, 1932:

Annual Members—\$3.00, to receive the two bulletins containing the miscellaneous material issued in 1932.

Contributing Members—\$25.00, to receive all publications issued during the coming year.

Life Membership—\$50.00, to receive all publications issued during their membership.

The question of furnishing our members copies of some of the material that the Society has on its walls was thoroughly discussed. For the benefit of our members, some of this material has been given this Society with the express stipulation that this material will not be copied. These wishes will be respected by the officers of the Society, not only for the material that we already have but for any that may be received in the future. On the other hand, such material that we have and on which no restrictions have been placed, we will furnish prints to our members with the stipulation that they shall not copy them and that they defray the cost of having these prints made. The cost will not only include the photographers charge, but that of taking down and replacing the original picture and such hauling charges to and from the photographer. These costs have not as yet been worked out by the Room Committee and applications for these copies should be made to Mr. John W. Merrill, 40 Broad St., Boston, Mass.

The Pennoyer Set of Colored Prints

Last June a notice was sent to our members notifying them that the Society would distribute to its members a set of these four colored prints.

The originals, from which these prints are made, are large mural paintings and were executed by Mr. A. Sheldon Pennoyer, a well known artist and a member of this Society. Their execution so impressed the Editors of "Fortune" that they appeared in that magazine. Believing that our members would value the possession of these sets, a limited number was made from these plates, before the plates were destroyed.

The subjects offered include a Crampton type of locomotive in use on the Camden & Amboy R. R. in 1850; the "Pioneer" on the Cumberland Valley, built by Seth Wilmarth in 1851; An American Express train pulled by a Rogers locomotive of the '70's and through the kindness of the Delaware & Hudson Co., the "Stourbridge Lion", 1829, imported from England, has been included in this set. Mr. Pennoyer has admirably grasped the technique of the locomotives of that period and placed them in familiar surroundings. The several colors used in the printing of these prints make them the most beautiful that have been reproduced in recent years. The edition is limited, no sets can be broken nor can any be sent on approval. The Society is very fortunate to be able to

offer a set of these four prints for \$5.00. The size of the "Pioneer" is 7x11 and the other three are 8¼x10½. They are worthy of a frame and once this limited edition has been sold, it can never be replaced. There are still a few sets left for our members.

A Transportation Center at Michigan

Nearly four years ago, certain parties connected with the University of Michigan, started the collection of books, papers, reference material and data, pertaining to Transportation. This included not only railroad transportation but all other forms such as turnpike, canal, inland river, ocean, air, etc. A tremendous amount of material has been received and their collection of material, while probably not the largest in this country, stands among one of the first five libraries on this subject.

Through the kindness of Professor Worley, Curator of the Transportation Library, Ann Arbor, Michigan, he wishes to extend to the members of this Society the complete use of this Transportation Library, either as a place to work or in their answering such questions as any of our members may have.

He has also offered the use of this Library as a repository for any material that our members may have. This may appeal to some of our members residing in the middle west who hesitate about sending material to us here in the east. For the information of our members, this Society has already been the means of placing some very interesting material at Ann Arbor and the place is well worth a visit if you are in the vicinity of Detroit. To those who wish to send material to Ann Arbor, it is suggested that you send them to Professor John S. Worley, addressed as above, marked for this Society, and notifying this Society at the Baker Library of your gift.

In the last few years we have accomplished a great deal here in the Baker Library. There is no reason why we cannot help the Transportation Library at the University of Michigan.

Wants of Our Members

Mr. A. R. Corinth, P. O. Box No. 938, Rocky Mount, N. C. is very anxious to secure copies of the Annual Reports of the Chicago, Burlington & Quincy R. R. dated 1854 and 1856. Mr. Corinth is very much interested in the history of this road and has a very good file of these reports. He needs these two to complete his file.

Mr. Frank Donovan, Jr., 135 Washington Lane, Wyncote, Pa. would like to buy or exchange, preferably exchange, books touching on steam and street railways, including novels and stories. He would also like to exchange photographs of horse and foreign street railways. He is also interested in interurban railway books, tickets, guides, maps, etc. of our electric railways. If any of our members have a similar interest, they are urged to get in touch with Mr. Donovan.

Locomotive Building at Manchester, New Hampshire

By CHAS. E. FISHER

THERE have been two locomotive building concerns in this northern city, the Amoskeag Company and the Manchester Locomotive Works. Both enjoyed a high reputation and the later company built an engine whose popularity was country wide.

The origin of the Amoskeag Manufacturing Company dates back to 1809. In that year, Benjamin Pritchard, with the three Stevens brothers, formed a partnership for the purpose of manufacturing cotton and woolen goods. A mill, forty feet square and two stories high, was erected on the banks of the Merrimac River at Amoskeag Village, then Goffstown. In 1810 a joint stock company was formed and the business incorporated under the name of the Amoskeag Cotton and Woolen Manufacturing Company. At this time there was no other cotton mill within the city limits of Manchester and in this one there was neither picker nor loom. The sole operation was spinning, the cotton being picked and the cloth woven in the homes of the neighboring people.

In 1825, Messrs. Larned Pitcher and Samuel Slater associated themselves with Willard Sayles, Lyman Tiffany, Oliver Dean and Ira Gray, four Massachusetts capitalists. Mr. Dean was made Agent. Under his management the firm expanded. The old mill was enlarged; two others erected, one of them on an island in the river, and the manufacture of shirtings, sheetings and tickings was undertaken.

On July 1st, 1831, the Legislature of New Hampshire granted to the above six gentlemen, a charter of incorporation of the Amoskeag Manufacturing Company, with an authorized capital of \$1,000,000.00. Again the business was enlarged. Land was purchased on both sides of the Merrimac, on the east side chiefly and these purchases were continued until nearly all the mill and power sites on the Merrimac River, between Manchester and Concord, with plenty of adjacent land, were owned by the Amoskeag Company. Thus as time passed the work of this company became divided into five distinct departments:

Land and Water Power Company

Amoskeag New Mills

Amoskeag Machine Shops and Locomotive Works

Amoskeag Batting Mill

The Hooksett Company

It was for the purpose of repairing their machinery and constructing such new machinery as became needed that the third department was created. In 1840 a shop 381x36 feet was built for just this purpose. In 1848 another shop, 320x40 feet was built. Both shops were three stories

high. The foundry, built in 1842 was replaced by another in 1848, 154x80 feet and the work of this department was gradually extended to include the building of steam boilers, turbine wheels, heavy tools, locomotives and steam fire engines.

The first locomotive built by the Amoskeag Company was the "Etna", built for the Northern R. R., (New Hampshire) in May, 1849. The locomotive was inside connected, 16x18" cylinders and weighed probably about twenty tons. It was in service on this road for thirty years. Two other locomotives were built that year and for the list of the first one hundred locomotives built by the Amoskeag Co., our readers are referred to Bulletin #5 in which this information was reproduced.

In 1853, Mr. John C. Moore paid a visit to these works and the following is his description of what he saw there relative to locomotive building:

"I was soon introduced to the locomotive department, where, amid the clanking of ponderous hand tools, the thundering music of a multitude of tilt hammers of all sorts and sizes, the rasping sound of files and the dull solidity of sound which the monster planing and punching machines give forth, I discovered some half a dozen large locomotives in progress, besides one outside the door in process of being fired up for a testing operation.

"These engines were in various stages of forwardness, one nearly finished. The finished engine to which I referred was designed for the Ohio & Pennsylvania Railroad, was some twenty-four tons weight and was named Missouri. It is, in all its parts, not excluding the ornamental (the mere finishing of which was only required) one of the most splendid engines I have ever seen. It was numbered 124 and took the prize at the late State Fair. They now have thirty-five in the course of construction and have lately received an order for twenty locomotives from the Northern Indiana Railroad.

"In the carpenters' department the accuracy and easiness of production was noticeable. I saw one of those coverings, or sheds, which form the engineers' shelter on locomotive engines, which had been sawed, planed, cut, morticed, beaded, ornamented and thoroughly prepared for the hand of the builder and everything done by machinery but the simple putting together and painting.

"In the locomotive department the heavier descriptions of planing and finishing are done. I noticed several of the large driving wheels with their cranked axles, moving round in the process of planing, which is accomplished by mathematical exactitude calculated to surprise the tyro in mechanics. I here saw turning lathes, calculated to operate on all sizes of material, from an inch to twenty feet in circumference. The cylinders for the locomotive are turned and prepared here and the process is one which to the uninitiated possesses much interest. The surprising accuracy with which these tubes of iron are shaved into proportion, inside and out as if they were made of wood, instead of the most solid iron, is wonderful to behold.

"From thence I went to the boiler and tank shop. Here the boilers and locomotive tenders are made. It happened to be the day after the fair when I paid my visit, on which account I am constrained to be

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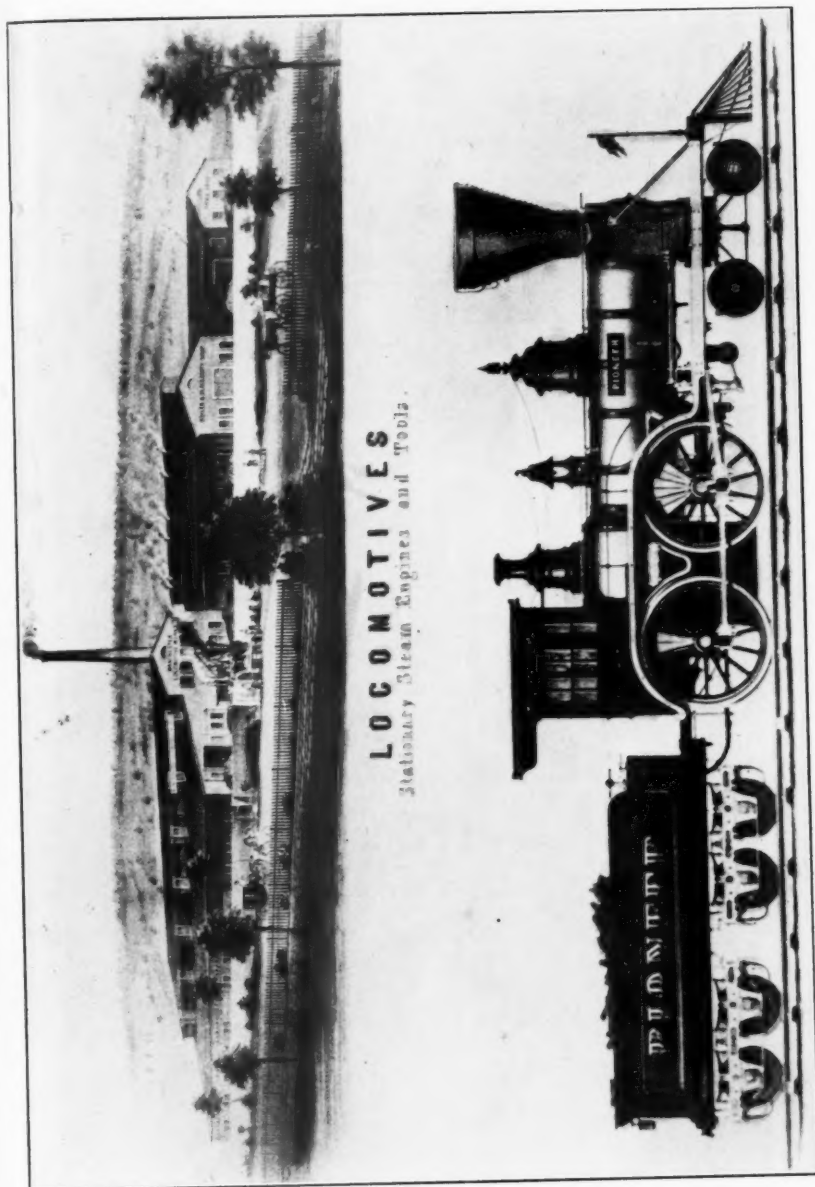


FIG. 1
Locomotive "Pioneer", the first locomotive built by the Manchester Locomotive Works.

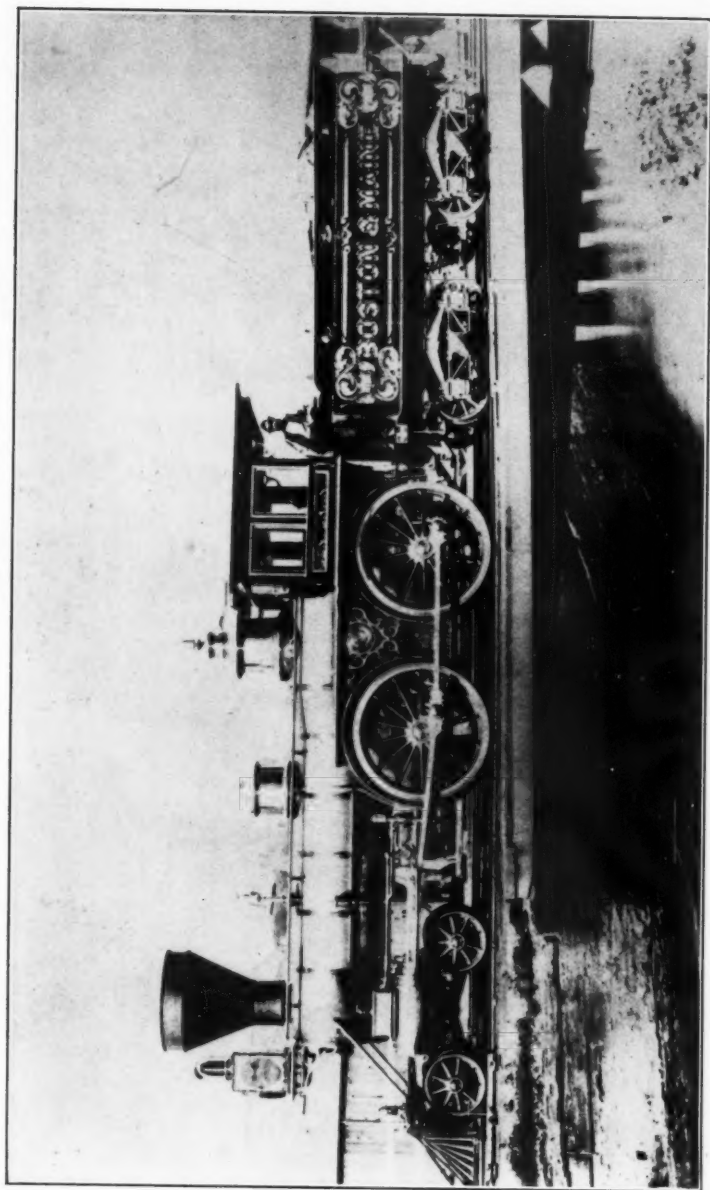


Fig. II
Boston & Maine "Gen'l. Grant"—Manchester 1867.

Fig. II
Boston & Maine "Gen'l. Grant"—Manchester 1867.

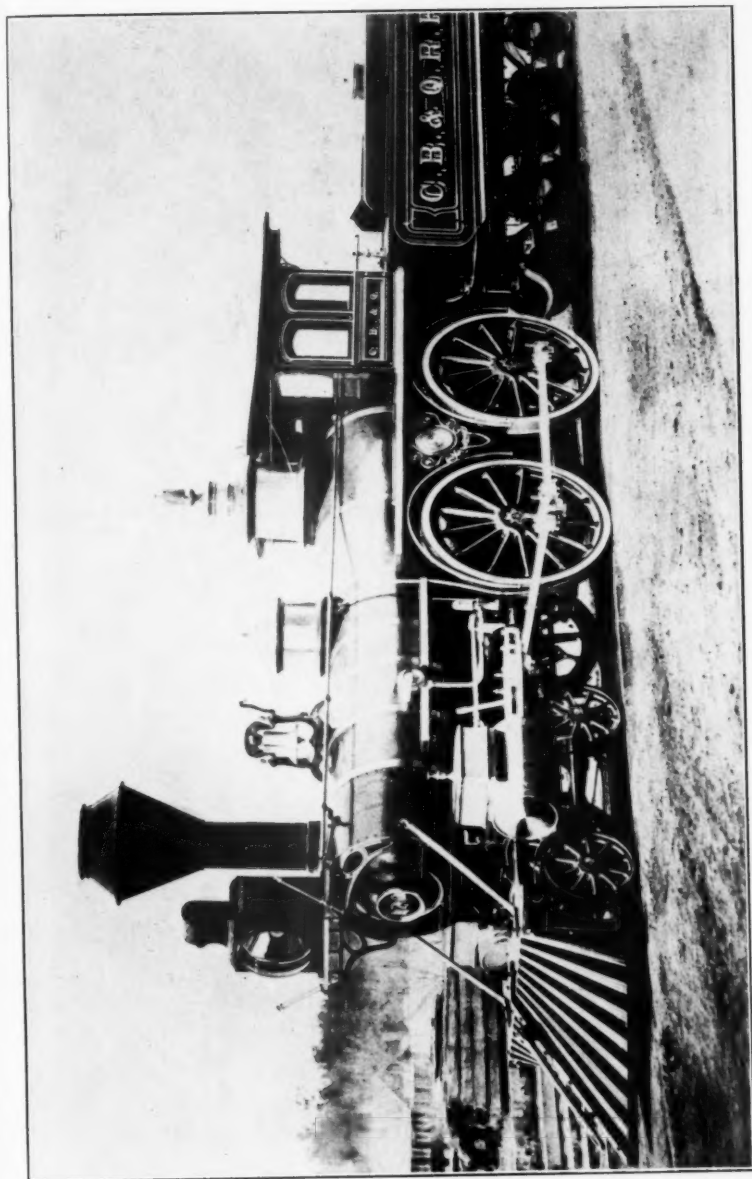


FIG. III
Chicago, Burlington & Quincy #170, Manchester, 1871.

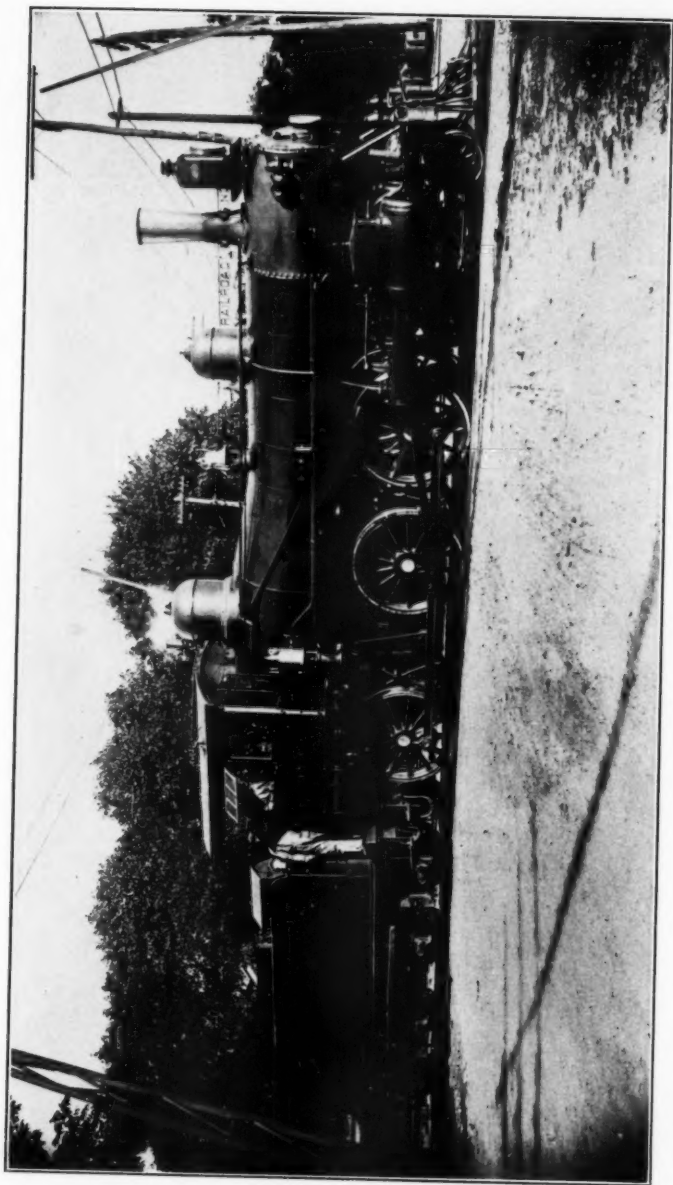


Fig. IV
N. Y. N. H. & H. #349—Manchester 1890.

thankful, for the cyclopean din was great enough with but a few at work, to satisfy me of the truth of the comparative saying:—'as noisy as a boiler maker.' I stood the hammering in of one rivet like a martyr and left, counting on my way back to the more peaceable regions some ten or twelve tenders in various stages of finish, besides the furnaces and boilers of as many locomotives."

One of the early experimental locomotives built by the Amoskeag Company was the "Mamaluke". This engine had a single pair of driving wheels, seven feet in diameter and with a walking beam on each side interposed between the cylinder and the driving wheel, one end of the beam being connected to the cylinder piston, the other end to the main rod and driving wheel. In a memorandum furnished by Mr. Inglis Stuart, the following details were derived from engineers who either saw the engine or had second hand knowledge:

"Henry S. Morrill of Hillsborough Bridge, N. H., who began his career under Simon R. Clark, then running the 'Sunapee', a Souther and the 'Central', a Hinkley, on the New Hampshire Central R. R., about 1852 or 1853, talked with me in February, 1914 about the 'Mamaluke'. He described it as it came from the Amoskeag Works and said that it had a single pair of drivers seven feet in diameter. That owing to these 'high' wheels the men of the road were afraid of it and difficulty was experienced in getting an engineer to run it. That on its trial run from Manchester up to Concord it attained a speed of a mile in forty-five seconds. He did not mention that it was inside and outside connected. This is about all he said. I found him clear in mind but very feeble and his death occurred before I could make a further call, I believe a couple of months later.

"Mr. Simon R. Clark in one of our conversations in 1920 alluded incidentally to the 'Mamaluke' and confirmed Mr. Morrill's remarks about the 'high wheels' and the fear engineers felt. He left the Northern (N. H.) R. R. about 1853 or 4 and he did not know what became of the engine, but remarked that it was altered by the Amoskeag Works to a 4-4-0 with lowered drivers.

"Charles C. Rowell, who came to the Northern (N. H.) R. R. about 1854, spoke about the 'Mamaluke' last year (1929) but his knowledge was derived from older engineers who had seen the 'Mamaluke'. He stated that after the alterations it was sent to the Vermont Central and not being deemed a serviceable locomotive by that corporation it was sent away, but where he did not know.

"The Amoskeag's 'Mamaluke' must not be confused with a contemporaneous 'Mamaluke' on the Michigan Central. The latter was constructed by the Detroit Locomotive Works. It is possible that the Amoskeag Works, after altering the 'Mamaluke' as to cylinders and drivers, may have sent it out under another name. This, of course, would make identification very uncertain."

However, the "Mamaluke" was merely an experiment. The Amoskeag Works constructed a good engine due to the skill and energy of Mr. O. W. Bailey and their locomotives not only went to several of our New England roads but to roads in the mid-west and to Canada.

For six years the Amoskeag Company built locomotives. The maximum reached was sixty a year during 1853. The last order of engines that we have any record of were six locomotives delivered to the Grand Trunk Ry. in 1858, numbered 175-181 incl. A total of 232 locomotives were built during these six years. The building of steam fire engines, of which this company was justly famous, was continued but the building of locomotives must have ceased about the time of the panic of 1857, the six engines delivered to the Grand Trunk having been built prior to 1858 and held waiting a customer.

Turning to the other locomotive building plant in Manchester, in 1853, Mr. O. W. Bailey who had been at the head of the machine shops of the Amoskeag Company, formed with Mr. Aretus Blood and Mr. J. M. Stone the firm known as Bailey, Blood and Company and were called the Vulcan Works. In June 1854, the above three men obtained a charter and the works were incorporated as the Manchester Locomotive Works. The capital stock was placed at \$300,000.00, one half of which was paid in. Mr. John A. Burnham was elected President in 1855, Mr. O. W. Bailey, former President was Agent, Mr. Wm. G. Means was Treasurer and Clerk and Messrs. Blood and Stone were foremen. Mr. Bailey, as has been mentioned brought to the company his experience with the Amoskeag Company; Mr. Aretus Blood brought his experience with the Essex Company at Lawrence, Mass. and Messrs. Means and Stone were able men in their respective capacities. In 1857 Mr. Blood, succeeded Mr. Bailey as Agent and for many years thereafter the name of "Blood" was associated with the locomotives built at Manchester.

Operations for building locomotives were commenced in Mechanics Row but in the spring and summer of 1854 shops of brick were built at the corner of Canal and Hollis Streets. They consisted of a building parallel with Canal Street, two stories high and 400x80 feet for a machine shop. A woodshop, two stories high 100x40 feet; a blacksmith shop 330x50 feet; a boiler shop 205x52 feet and later a tank shop 230x36 feet completed this plant. In 1865 the company purchased the foundry of the Manchester Iron Co. and here all the castings were made. In 1873 3,500,000 pounds of castings were made. The company made all the heavy forgings such as frames, axles, etc. and in 1875 seven hundred men were employed.

The first locomotive built was named the "Pioneer". It was an eight wheel standard type of engine, outside connected, 15x20" cylinders, 60" drivers and weighed 24 tons. The boiler was 42" in diameter with copper tube sheets and tubes. The tender had a capacity of 1400 gallons. Although built in 1854, delivery could not be effected until a customer was found. In 1855, the engine was renamed "Cossack" and with another engine of similar size named the "Corsair", both were delivered to the Central Military Tract R. R., now a part of the Chicago, Burlington & Quincy R. R. The capacity of the plant at this time was about three locomotives a month and up to 1857, forty-six locomotives had been built.

The general business depression of 1857 caused the discontinuance of locomotive building. The plant was leased to Mr. Aretus Blood who conducted a general machine shop under his own name, building portable

saw mill engines, wood planers, machine tools and work of this character. Locomotive building was not resumed until 1863. In that year nine locomotives were built or building was commenced but delivery was not made until 1864 when four of them went to the United States Military R. R. and the balance to various roads.

Among the first forty-six engines built prior to 1857, a brief description of one of them found in "Colburn's Railroad Advocate" for February 23, 1856 with Mr. Bailey's patent locomotive firebox is of interest. The Chicago, Burlington & Quincy R. R., interested in using coal for fuel ordered this firebox applied to one of its engines, then building at Manchester. The following is a brief description of this firebox:

"The upper and lower portions are divided by an inclined water space, making a complete floor for the upper part and a ceiling for the lower part. This water table or partition extends from the upper part of the back or door sheet of the firebox diagonally to below the bottom tubes. A vertical central water space extends from the under side of this partition, and runs the whole length of the firebox, thus subdividing the lower chamber of the firebox into two parts. Each part has a grate at the bottom and a feeding door behind. The two lower chambers communicate with each other by an opening through the central upright water space. And each part communicates with the upper chamber by a square opening through the inclined water space. The two openings through this water space have each a damper.

"The firebox is fired as follows: The right hand door is opened, the right hand damper closed and the left hand damper left open. Coal is put in the right hand lower chamber, the gas, sparks and smoke of which can only escape by passing through the opening in the central water space on to the fire in the left hand lower chamber. From here it rises through the left hand damper into the lower chamber and passes off through the tubes. On the next firing, the left hand grate is fed and the right hand damper opened, thus alternating from left to right.

"The advantages of this firebox are these. All the sparks, smoke and gas of the coal are consumed by passing over an adjoining fire, and the current of heated air is diverted from the tubes enough to give time for a complete combustion of all the crudities escaping from fresh coal. Again, the combustion chamber, above the inclined water space, equalizes the action of the draft on the coal, avoiding the impulsive cutting action usually experienced. Next, the flying particles of coal are kept away from the tubes, and are either burnt while in motion, or fall back and burn on the fire instead of passing off through the chimney. The central water space absorbs much of the heat at the center of the fire, making it more manageable, and less destructive to the firebox. The whole system of the water spaces adds some forty square feet of the most valuable heating surface in the boiler. The upper firebox will last for years. It is not likely to burn or cut out. When the lower firebox burns out, it can be easily cut away and renewed. The water spaces are so proportioned and disposed as to facilitate the free ascent of steam, and ready circulation of water.

"The engine drew 22 eight wheeled cars from Manchester via Lawrence to Boston, 52 miles, using 3300 gallons of water and 3000 pounds of coal. Each pound of coal evaporated 9 pounds of water. Allowing for waste through pet cocks and other sources, the builders reckon the effective evaporation at $8\frac{1}{2}$ pounds of water to the pound of coal. This, although large, they expect to exceed in future engines with good coal."

The article mentions that the Hudson River Railroad will probably try this type of firebox on some of its engines. The name or number of this engine to which this firebox is applied on the Chicago, Burlington & Quincy R. R., is, I am sorry to state, not given.

With the settlement of the differences between the North and the South, locomotive building activities were resumed at the Manchester Works. Although only seventeen engines were built in 1865, it was not long before these works were turning them out more rapidly. The product of these works were purchased by railroads in all sections of the country. The Chicago, Burlington & Quincy; Hannibal & St. Joseph; Atchison Topeka & Santa Fe; Michigan Central and Boston & Maine placed many an order for engines with Mr. Aretas Blood. There is scarcely a section of this country but that has not heard the note of the Manchester bell.

Mr. Blood and his associates were able men. They built an exceedingly neat and trim looking locomotive, after the ideas incorporated by William Mason. Indeed, on the later Manchester engines, the bell yoke, save that the arms turned down was identical with that used by Mr. Mason. The bell however, was of a different pitch. Perhaps the illustrations will serve better than mere words to describe the product of this works.

In 1872, Mr. Blood who had become by this time the principal owner of the works, purchased the steam fire engine business known as the "Amoskeag Engine" from the Amoskeag Co. It was in this year that the first self-propelled steam fire engine was built and it was delivered to the New York City Fire Department, their Engine No. 10. The gearing on the back axle, known as a "differential gear", was similar to that used on the automobile today. These "Amoskeag Engines" went to many cities in this country and abroad and when the Manchester Locomotive Works became a part of the American Locomotive Co., the steam fire engine business did not go with it. Steam fire engines were built under contract until 1908 when the business was transferred to Providence, R. I.

On November 24, 1897, Mr. Aretas Blood who had so long been identified with these works, died. He was succeeded by Mr. Charles T. Means, son of Mr. William G. Means, one of the associates of Mr. Blood when the business was started. With the increase in the business that had taken place in the last few years, the plant was more or less crowded and it became increasingly difficult and dangerous to handle larger locomotives. Accordingly, when the American Locomotive Company was formed in 1901 and the opportunity presented to become a part of this organization, Mr. Means disposed of his interest and retired from active management. Thus, from the inception of this plant, to July 1, 1901, 1793 engines had been built by the Manchester Locomotive Works.

Under the control of the American Locomotive Co., locomotives were still built and a great deal of repair work was done for the Boston & Maine Railroad. In fact this road did not have any large repair shops of their own until locomotive building finally ceased at this point. Possibly the heaviest locomotives built at this point were locomotives of the Atlantic type built for the Boston & Maine R. R., 1908-1909, with 19x28" cylinders, 80" drivers and weight of 181600 pounds. As long as there was a demand for the lighter type of locomotives, the American Locomotive Co. kept this plant in operation, but with the railroads ordering heavier power, the cost of rebuilding this plant and its location was such as to cause these in control to close the works. It has been fifteen years now since a locomotive has been built at these works, thus marking the end of a once prosperous business which employed hundreds of men in Manchester, N. H.

Through the kindness of the American Locomotive Co., I am able to list the first one hundred engines built by the Manchester Locomotive Works:

- # 1 Central Military Tract R. R., "Cossack", Mar. 24, 1855, 15x20" 60"
48000
- 2 Central Military Tract R. R., "Corsair", Mar. 24, 1855, 15x20" 60"
48000
- 3 Chicago & Aurora R. R., "Troubadour", Apr. 11, 1855, 15x20" 66"
48000
- 4 Central Military Tract R. R., "Arab", Apr. 11, 1855, 15x20" 60"
48000
- 5 Chicago, Burlington & Q. R. R., "Tartar", May 10, 1855, 15x20" 60"
48000
- 6 Chicago, Burlington & Q. R. R., "Talisman", May 10, 1855, 15x20"
66" 48000
- 7 C. S. Gzowski & Co., May 26, 1855, 15x20" 72" 54000
- 8 C. S. Gzowski & Co., June 5, 1855, 15x20" 72" 54000
- 9 C. S. Gzowski & Co., June 16, 1855, 15x20" 72" 54000
- 10 C. S. Gzowski & Co., June 26, 1855, 15x20" 72" 54000
- 11 C. S. Gzowski & Co., July 11, 1855, 15x20" 72" 54000
- 12 C. S. Gzowski & Co., July 31, 1855, 15x20" 72" 54000
- 13 C. S. Gzowski & Co., Aug. 22, 1855, 15x20" 72" 54000
- 14 Northern R. R., "Onslow Stearns", Aug. 19, 1855, 16x24" 60" 52000
- 15 Chicago, Burlington & Q. R. R., "North Wind", Aug. 18, 1855, 16x20"
66" 52000
- 16 Chicago, Burlington & Q. R. R., "South Wind", Oct. 11, 1855, 16x20"
66"
- 17 Chicago, Burlington & Q. R. R., "West Wind", Oct. 2, 1855, 16x20"
66"
- 18 Chicago, Burlington & Q. R. R., "Grey Eagle", Sep. 13, 1855, 16x20"
66"
- 19 Chicago, Burlington & Q. R. R., "Golden Eagle", Oct. 25, 1855,
16x20" 66"
- 20 Wilmington & Weldon R. R., "Orange", Aug. 30, 1855, 13x24" 60"
- 21 Manchester & Lawrence R. R., "James Madison", Sept. 25, 1855,
16x24" 60"
- 22 Ohio & Pennsylvania R. R., "Frederick Lorenz", Nov. 1, 1855,
16x22" 66"
- 23 Ohio & Pennsylvania R. R., "Louisville", Nov. 13, 1855, 16x22" 66"
- 24 Chicago, Burlington & Q. R. R., "Wataga", Feb. 19, 1856, 15x22"
54"
- 25 Galena & Chicago Union R. R., "Nevada", Dec. 26, 1855, 15x24" 60"
- 26 Northern R. R. (See Note), 1855, 15x22" 60"

- 27 Racine & Mississippi R. R., "Prairie Flower", June 2, 1856, 15x22" 60" 50000
- 28 Northern Cross R. R., "General Taylor", Feb. 1, 1856, 15x24" 60" 50000
- 29 Northern Cross R. R., "John Wood", Feb. 1, 1856, 15x24" 60" 50000
- 30 Chicago, Iowa & Nebraska R. R., "Clinton", Aug. 25, 1856, 15x24" 60" 50000
- 31 C. S. Gzowski & Co., Feb. 19, 1856, 16x20" 60"
- 32 C. S. Gzowski & Co., Mar. 5, 1856, 16x20" 60"
- 33 C. S. Gzowski & Co., Apr. 2, 1856, 16x20" 60"
- 34 Chicago, Burlington & Q. R. R., #52, July 18, 1856, 15x24" 60" 60000
- 35 Chicago, Burlington & Q. R. R., #53, Aug. 11, 1856, 15x24" 60" 60000
- 36 Chicago, Burlington & Q. R. R., #54, Sep. 8, 1856, 15x24" 60" 60000
- 37 Chicago, Burlington & Q. R. R., #55, Sep. 18, 1856, 15x24" 60" 60000
- 38 Chicago, Burlington & Q. R. R., #51, Sep. 18, 1856, 15x24" 56" 60000
- 39 Chicago, Burlington & Q. R. R., #50, 1856, 15x24" 56" 60000
- 40 Chicago, Burlington & Q. R. R., #49, 1856, 15x24" 56" 60000
- 41 Chicago, Burlington & Q. R. R., #48, 1856, 15x24" 56" 60000
- 42 Chicago, Burlington & Q. R. R., #47, 1856, 15x24" 56" 60000
- 43 Chicago, Burlington & Q. R. R., #56, 1856, 15x24" 56" 60000
- 44 New London Northern R. R., "Thames", 1857, 15x22"
- 45 Wilmington & Weldon R. R., "Wilmington", 1857, 46000
- 46 Wilmington & Weldon R. R., "Gov. Bragg", 1857, 46000
- 47 Chicago & North-Western Ry., "James R. Young", Dec. 27, 1864, 16x22" 66" 57000
- 48 Boston, Lowell & Nashua R. R., "Lowell", July 8, 1864, 16x22" 66" 57000
- 49 Vermont & Massachusetts R. R., "Whittemore", June 20, 1864, 15x20" 60"
- 50 Union Pacific R. R., July 27, 1864, 14x22" 60"
- 51 Union Pacific R. R., Aug. 27, 1864, 14x22" 60"
- 52 Chicago & North-Western Ry., "H. H. Boody", Jan. 1, 1865, 16x22" 66"
- 53 Old Colony & Newport Ry., "Puritan", Feb. 1, 1865, 16x22" 60" 59000
- 54 LaCrosse & Milwaukee R. R., #43, Jan. 31, 1865, 16x24" 60" 60000
- 55 LaCrosse & Milwaukee R. R., #44, Feb. 15, 1865, 16x24" 60" 60000
- 56 United States Military R. R., #94, Sep. 30, 1864, 16x24" 60" 60000
- 57 United States Military R. R., #95, Sep. 30, 1864, 16x24" 60" 60000
- 58 United States Military R. R., #96, Oct. 31, 1864, 16x24" 60" 60000
- 59 United States Military R. R., #97, Nov. 23, 1864, 16x24" 60" 60000
- 60 New London Northern R. R., "Montague", Mar. 13, 1865, 15x24" 60" 56000
- 61 Old Colony & Newport Ry., "Electric", Mar. 31, 1865, 16x22" 66" 59000
- 62 Hannibal & St. Joseph R. R., "Colorado", Apr. 27, 1865, 16x24" 54" 60000
- 63 Hannibal & St. Joseph R. R., "Idaho", May 10, 1865, 16x24" 54" 60000
- 64 Hannibal & St. Joseph R. R., "Utah", May 26, 1865, 16x24" 54" 60000
- 65 Hannibal & St. Joseph R. R., "Nevada", June 12, 1865, 16x24" 54" 60000
- 66 Racine & Mississippi R. R., "Gen. Sherman", 1865, 16x24" 60" 58000
- 67 Concord, Manchester & Lawrence R. Rs., "Gen. Grant", Aug. 30, 1865, 16x24" 60" 53000
- 68 Hannibal & St. Joseph R. R., "Sonora", Aug. 26, 1865, 16x24" 54" 60000

- 69 Hannibal & St. Joseph R. R., "Montana", Sept. 7, 1865, 16x24" 54" 60000
- 70 Hannibal & St. Joseph R. R., "Oregon" Sep. 25, 1865, 16x24" 54" 60000
- 71 Old Colony & Newport Ry., "Empire" Dec. 15, 1865, 16x24" 66" 60000
- 72 Vermont Central R. R., "Gen. Grant" Dec. 25, 1865, 16x24" 60" 60000
- 73 Vermont Central R. R., "Gen. Stannard" Jan. 11, 1866, 16x24" 60" 60000
- 74 Burlington & Missouri River R. R., "John G. Read" Feb. 14, 1866, 16x24" 60" 60000
- 75 Burlington & Missouri River R. R., "Gen. Lowell", Feb. 26, 1866, 16x20" 60" 60000
- 76 Vermont Central R. R., "Gen. Sherman", Apr. 17, 1866, 16x24" 60" 60000
- 77 Vermont Central R. R., "Gen. Sheridan" Apr. 17, 1866, 16x24" 60" 60000
- 78 South Shore R. R., "T. Henry Perkins" Mar. 27, 1866, 14x22" 60" 54000
- 79 Old Colony & Newport Ry., "King Philip", May 31, 1866, 16x24" 66" 60000
- 80 Connecticut & Passumpsic R. R. "Union", May 15, 1866, 15x24" 60" 50000
- 81 New London Northern R. R., "Canada" Aug. 1, 1866, 16x24" 60" 60000
- 82 Chicago & North-Western Ry., "Blair" Aug. 20, 1866, 16x24" 60" 60000
- 83 Boston & Maine R. R., "James Hayward", Oct. 29, 1866, 16x24" 60" 60000
- 84 Boston & Maine R. R., "Shawmut" Nov. 21, 1866, 16x24" 60" 60000
- 85 New London Northern R. R., "A. N. Ramsdell" Dec. 4, 1866, 16x24" 60" 60000
- 86 Pierce & Bacon "Gen. Longstreet" July 3, 1866, 13x22" 60" 49000
- 87 Connecticut & Passumpsic R. R., "A. Gilmore" July 5, 1866, 14x22" 60" 50000
- 88 Pierce & Bacon "Magg. Nichols" Sep. 17, 1866, 13x22" 60" 49000
- 89 New London Northern R. R., "H. P. Haven" Sep. 17, 1866, 15x20" 60" 57000
- 90 New London Northern R. R., "Norwich" Jan. 4, 1867, 16x24" 60" 60000
- 91 Sioux City & Pacific R. R., "W. W. Walker" July 29, 1867, 16x24" 60" 60000
- 92 Michigan Southern & Northern Indiana R. R., "Gen. Stark" Aug. 19, 1867, 16x24" 60" 60000
- 93 Michigan Central R. R., "Monitor", Apr. 25, 1867, 16x24" 60" 61000
- 94 Michigan Central R. R., "Meteor", May 8, 1867, 16x24" 60" 61000
- 95 Michigan Central R. R., "Gladiator" June 5, 1867, 16x24" 60" 61000
- 96 Peoria, Pekin & Jacksonville R. R. #8, June 11, 1867, 15x24" 60" 60000
- 97 Boston & Maine R. R., "Gen. Grant" June 12, 1867, 16x24" 66" 60000
- 98 Androscoggin R. R., "Lewiston" July 29, 1867, 15x24" 60" 54000
- 99 Burlington & Missouri River R. R., "John W. Brooks" Sep. 26, 1867, 16x24" 60" 60000
- 100 Burlington & Missouri River R. R., "J. M. Forbes", Oct. 15, 1867, 16x24" 60" 60000

NOTE—In regard to M. L. W. #26, Mr. Inglis Stuart advises this locomotive was named the "G. A. Ketell", but on being damaged during its trial trip at East Andover, N. H., the Northern R. R. declined to accept it. It was taken back to Manchester, repaired and sent to the Chicago, Burlington & Quincy R. R. under its name. Soon afterwards the second "G. A. Ketell" came from the Manchester Works.

The Locomotives of the Boston & Maine Railroad

By CHAS. E. FISHER

THE late Herbert P. Yeaton of Washington, D. C. was born in Stoneham, Massachusetts. To those of us who knew him and enjoyed his friendship, we realized fully his keenness in his search for historical data pertaining to locomotives and while he was alive he did much to help the growth of this Society. Born in a section served by the Boston & Maine Railroad, his interests were first towards that road. He amassed a large collection of photographs of the engines of the Boston & Maine and its subsidiaries but his chief work and for what he will always be remembered is the list of locomotives of the Boston & Maine and subsidiary roads that he distributed to his friends.

This list of locomotives is dated at Washington, D. C., December 31, 1914 and was prepared together with the assistance of John W. Merrill, G. F. Starbuck, F. S. Wyman, Herbert Fisher, Benj. Thomas, Geo. E. Cummings and the writer of this article or compiler of this material, as you wish. No one who has studied this work can but help appreciate the long and weary hours that went into its preparation.

Mr. Yeaton died on October 31st, 1925 in connection with his duties on the Southern Ry. It was not but a short time after his death that certain copies of this work were circulated by another party, not a member of this Society, for his friends and acquaintances. This list, however, is so interesting and so valuable, that your Editor, has decided to reproduce it, in sections, in the BULLETIN. In presenting this list, it must be fully understood that the credit belongs to Mr. Herbert P. Yeaton and his associates. The original list, as presented, has some blank spaces and wherever it is possible, these have been filled in, the information coming from the Annual Reports to the Stockholders, copies of which are in the Baker Library. Such corrections as have been made are also based upon these reports. Such records of the locomotive builders will also be referred to under their numbers. In other words, the list as presented by Mr. Yeaton has been checked with these railroad reports and builder's records and any changes made in Mr. Yeaton's list are on account of this checking.

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It may not be amiss to state something about the early Boston & Maine R. R. This road had its beginning in a road known as the Andover & Wilmington Railroad, organized on March 15, 1833, to construct a railroad from Andover to a connection with the Boston & Lowell Railroad at Wilmington, Mass. This road was opened in August, 1836. Under the name the Andover & Haverhill Railroad, the road was extended to Haverhill, Mass., in 1838. On April 3rd, 1839 the name was again changed to the Boston & Portland Railroad and the road extended to Exeter, New Hampshire on January 1, 1840 and to Dover, New Hamp-

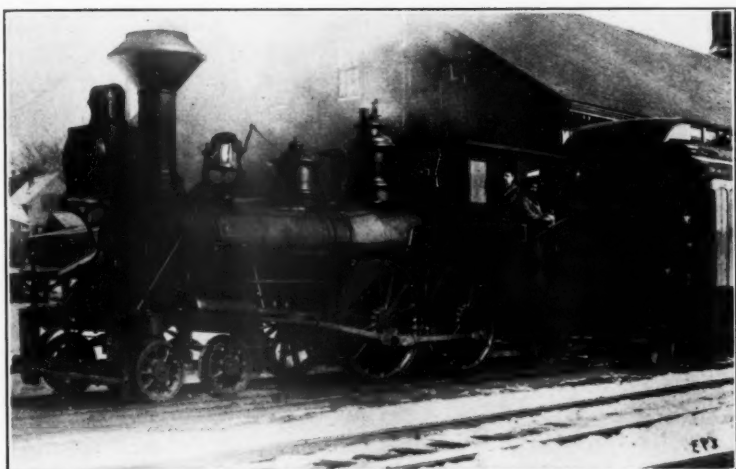


FIG. I

B. & M. "Medford", Stated by Mr. Yeaton as coming from the Eastern R. R. in 1870.



FIG. II

B. & M. "Titan"—Manchester, 1872.

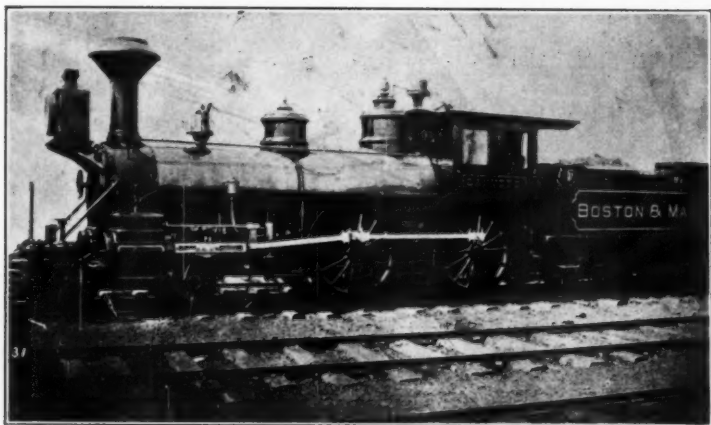


FIG. III

B. & M. "Danvers"—Hinkley, 1879.

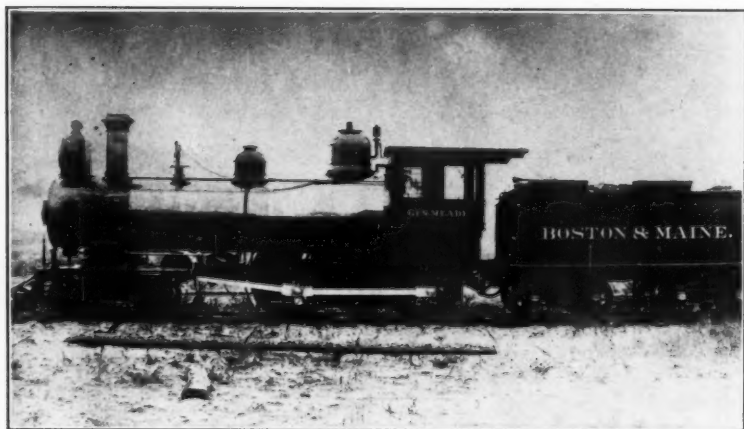


FIG. IV

B. & M. "Gen'l. Meade"—Portland, 1887.

shire on Nov. 1, 1841. On January 1, 1842 the name of the Boston & Maine Railroad was adopted and on February 1, 1843 it was opened to South Berwick, Maine, where connections were made with the Portland, Saco & Portsmouth Railroad for Portland traffic. One of the early reports refers to the road as "a branch of the Boston & Lowell from Wilmington to Bradford, a distance of seventeen miles". It is not my purpose in presenting these lists to write the history of the road. It has been very well done by the late F. B. C. Bradlee and his works on the Eastern, the Lowell Roads and the Boston & Maine, published by the Essex Institute of Salem, Mass, are well known and are worth a place in one's library if interested in the subject of the history of these roads. Suffice it to say that this was the beginning of the Boston & Maine Railroad and other roads were added either by lease or purchase of stock.

The U. S. Report of 1838, listing the locomotives in this country and reproduced in our BULLETIN No. 6, credits three locomotives to the Andover & Haverhill Railroad. They were the "Andover" and "Haverhill", both of 30 h. p., built by the Locks & Canal Co. of Lowell in 1836. The third is the "Rockingham", 30 h. p., Locks & Canal Co., built in 1837. The report of 1836 of that road mentions that "two engines have been ordered from Lowell to be delivered next July (1836) in time to open the road". So much for the early engines as subsequent reports fail to give any details relative to their locomotives.

The reports of the Boston & Maine Railroad are not without interest. A copy of the investigation of the road, 1849, reveals a list of locomotives valued by Mr. George S. Griggs, who was the Master Machinist of the Boston & Providence Railroad. In addition to the above three mentioned engines are several more and while the name of the builder is not included in this list, the Hinkley records have been added in ().

BOSTON & MAINE RAILROAD.

Engines valued by Mr. George S. Griggs.

Andover	\$2700.00	(Locks & Canal 1836) (From Andover & Haverhill R. R.)
Haverhill	2900.00	(Locks & Canal 1836) (From Andover & Haverhill R. R.)
Rockingham	2000.00	(Locks & Canal 1837) (From Andover & Haverhill R. R.)
Cochecho	2000.00	
Augusta	3000.00	
Dragon	6000.00	
Portland	3000.00	(Hinkley & Drury # 14, 1843, 11½x20" 63" 4-2-0)
Reading	3000.00	(Hinkley & Drury # 30, 1844, 11½x20" 66" 4-2-0)
Malden	4000.00	(Hinkley & Drury # 32, 1845, 11½x20" 60" 4-2-0)
Gollah	3000.00	
# 21	7000.00	(Hinkley & Drury #121, 1847, 15x20" 54" 4-4-0)
22	6600.00	(Hinkley & Drury #172, 1848, 14x18" 60" 4-4-0)
23	8000.00	
24	8000.00	
25	6500.00	
26	6500.00	
New Hampshire	6000.00	(Hinkley & Drury # 93, 1847, 16x20" 46" 4-6-0)
Maine	7500.00	(Hinkley & Drury #106, 1847, 16x20" 46" 4-6-0)
Antelope	5000.00	(Hinkley & Drury # 52, 1845, 11½x22" 72" 4-2-0)

Bangor	5000.00	(Hinkley & Drury # 56, 1845, 14x18" 60" 4-4-0)
Massachusetts	5000.00	(Hinkley & Drury # 57, 1846, 14x18" 60" 4-4-0)
Norris	6000.00	
Lawrence	6500.00	(Hinkley & Drury #118, 1847, 15x18" 60" 4-4-0)

From 1856-1865 inclusive, the Boston & Maine R. R., at the end of their Annual Report, listed their locomotives. The name of the builder is not given however. The list of 1856 is shown herewith and such notations as subsequent reports reveal.

BOSTON & MAINE RAILROAD—1856—ANNUAL REPORT.

Andover	12 ¾ x16"	60"	11 tons	(Disappears prior to 1857)
Augusta	12 ¾ x16"	60"	11 tons	(Disappears prior to 1858)
Antelope	11 ¾ x22"	66"	13 tons	
Bangor	14 ¼ x18"	66"	19 tons	(Disappears prior to 1863)
Boston	14 ¼ x18"	60"	19 tons	
Bay State	14 ¾ x20"	66"	22 tons	
Ballard Vale	14 ¼ x18"	60"	19 tons	
Cocheco	12x16"	60"	12 tons	(Disappears prior to 1863)
Dragon	12x20"	54"	24 tons	
Dover	15x20"	54"	24 tons	(Disappears prior to 1863)
Exeter	15x20"	54"	24 tons	(Disappears prior to 1863)
Essex	15x18"	54"	24 tons	
Granite State	14 ¾ x20"	54"	22 tons	
Haverhill	12 ¾ x16"	60"	11 tons	(Disappears prior to 1858)
Hinkley	15x20"	66"	23 tons	
Lawrence	15x18"	60"	22 tons	
Massachusetts	14 ¼ x18"	66"	19 tons	
Maine	16 ¼ x20"	46"	25 tons	
Malden	11 ½ x20"	66"	13 tons	(Disappears prior to 1861)
New Hampshire	16 ¼ x20"	46"	25 tons	
Norris	14x22"	66"	20 tons	
Ogliochook	14x18"	60"	19 tons	(Disappears prior to 1863)
O. W. Bayley	15x20"	66"	23 tons	
Portland	11 ¾ x20"	63"	12 tons	
Reading	11 ¾ x20"	66"	13 tons	
Rockingham	15x24"	54"	24 tons	
Vermont	15x20"	54"	23 tons	(Disappears prior to 1864)
Swamscot	13 ½ x20"	54"	14 tons	
United States	15x24"	60"	24 tons	
Merrimack	16x24"	66"	25 tons	
Thomas West	16x20"	66"	25 tons	
Atlantic	15x22"	66"	25 tons	
Pacific	15x22"	66"	25 tons	

The Report of 1860 adds the following:

Yankee	14x22"	66"	23 tons
Newburyport	14x22"	66"	23 tons
Camilla	14x20"	60"	21 tons
Mythic	14x20"	60"	21 tons

The Report of 1861 adds the following:

Andover	15x22"	66"	25 tons
Ajax	15x24"	60"	27 tons
Hercules	16x24"	60"	27 tons
Medford	11 ½ x20"	60"	16 tons

This must have been the "Malden" rebuilt as the "Bangor" is listed up to 1862.

The report of 1862 adds the following:

Haverhill (2nd) 14x22" 66" 25 tons

The report of 1863 adds the following:

Wannalancet 14x20" 60" 20 tons (Report states two engines sold to U. S. M. R. R.)

Memecho 14x20" 66" 20 tons

The report of 1864 adds the following:

Exeter (2nd) 15x22" 66" 27 tons

Rochester 15x22" 60" 24 tons

Alton Bay 14x18" 60" 20 tons

The report of 1865 adds the following:

Strafford 15½x22" 66" 27 tons

This report concludes the engines owned by the Boston & Maine R. R.

Turning now to Mr. Yeaton's list, such engines as did not carry numbers, he has placed first. In 1911 the Boston & Maine R. R. renumbered their locomotives and the numbers on this list are the series prior to this renumbering. Names were removed from the Boston & Maine locomotives in 1892.

Meteor	Locks & Canal	1839	Scrap B & M
Berwick	Locks & Canal	1839	Scrap B & M
Whistler	Locks & Canal	1844	Scrap B & M
Medford	Locks & Canal	1844, 1 pr drivers	Scrap B & M 1860
Bangor	Hinkley & Drury	\$ 56, 1845, 14x18" 4-4-0	Reb "Medford" (?)
Cochecho	Hinkley & Drury	? 1845, 12x16"	Sold U S M R 1863
Augusta	Hinkley & Drury	? 1849, 12½x16"	Scrap B & M 1858
Goliath	Hinkley & Drury	\$? 1849,	Scrap B & M 1858
Malden	Hinkley & Drury	\$ 32, 1845, 11½x20" 4-2-2	Scrap B&M 1861
Dover	Hinkley & Drury	? 1856, 15x20" 4-4-0	Sold U S M R 1863
Oglochook	Hinkley & Drury	? 1856, 14x18" 4-4-0	Sold U S M R 1863
Vermont	Hinkley & Drury	? 1856, 15x20" 4-4-0	Sold York & Cumberland R R 1861
Express	Bos & Worcester	1858, 16x21" 4-4-0	Pur from B & W
Despatch	Bos & Worcester	1858, 16x21" 4-4-0	Pur from B & W
Yankee	Hinkley & Drury	\$ 532, 1854, 14x22" 4-4-0	Sold U S M R 1863 from Newburyport & Georgetown R R
Rochester	_____	_____	Scrap B & M 1864 from Dover & Winnepesaukee R R
Rochester (2nd)	_____	1864, 15x22"	
Alton Bay	Taunton L W	\$ 38, 1849, 14x18" 4-4-0	Reb. B & M 1864 from Dover & Winnepesaukee R R
Union	_____	16x22" 4-4-0	
1 Dragon	_____	1844, 12x20" 0-4-0	Scrap B & M
Dragon	_____	_____	Scrap B & M 1883
Dragon	B & M R R	1884, 15x22"	Sold to Woodstock Ry.
2 Portland	Hinkley & Drury	\$ 14, 1843, 11½x20" 4-2-0	Scrap B&M 1864
Portland	B & M R R	1865, 15x22" 0-4-0	Scrap B & M 1903
3 Reading	Hinkley & Drury	\$ 30, 1844, 11½x20" 4-2-2	Scrap B&M 1876
Reading	Hinkley	1879, 16x22" 4-4-0	Scrap B & M 1900

4 Medford	Hinkley & Drury	# 56, 1845, 11½x20" 4-4-0 Scrap B & M 1876	32
Medford	Eastern R R	1870, 15x22" 4-4-0 Scrap B & M 1893	33
5 Norris	R. Norris	1849, 14x22" 4-4-0 Scrap B & M	33
Norris		15x22" 4-4-0 Sold	3
6 Swampscott	Mason	# 719, 1885, 17x24" 4-4-0 Renumbered 702	35
Swampscott	Hinkley & Drury	# 48, 1845, 13½x20" 0-4-0 Scrap B & M 1882	36
	B & M R R	1883, 15x22" 0-4-0 Sold	36
7 Antelope	Hinkley & Drury	# 52, 1845, 11½x22" 4-2-2 Reb. 1860 4-4-0	37
Antelope	Hinkley	1878, 15x22" 4-4-0 Scrap B & M 1895	38
8 Memecho	Hinkley	1863, 14x20" 4-4-0 Scrap B & M 1875	39
Memecho	B & M R R	1875, 15x22" 4-4-0 Scrap B & M 1902	40
9 Massachusetts	Hinkley & Drury	# 57, 1846, 14x18" 4-4-0 Scrap B & M 1878	41
Massachusetts	Grant	#1185, 1878, 9x14" 0-4-0 Sold B & M 1902	42
10 New Hampshire	Hinkley & Drury	# 93, 1847, 16x20" 4-6-0 Reb. 1865 4-4-0	43
New Hampshire	Manchester	1874, 15x22" 4-4-0 Scrap B & M 1904	44
11 Maine	Hinkley & Drury	# 106, 1847, 16x20" 4-6-0 Reb. 1865 4-4-0	45
		Scrap B & M 1891	46
12 Hinkley	Hinkley & Drury	# 419, 1852, 15x20" 4-4-0 Scrap B & M 1885	47
Wyoming	Manchester	1886, 18x24" 4-4-0 Renumbered 862	48
13 Lawrence	Hinkley & Drury	# 118, 1847, 15x18" 4-4-0 Scrap B & M 1885	49
Stoneham	Manchester	1886, 18x24" 4-4-0 Renumbered 863	50
14 Boston	Ballard Vale	1848, 14¼x18" 4-4-0 Scrap B & M 1867	51
Boston		Scrap B & M 1887	52
Boston	Hinkley	1888, 18x24" 4-4-0 Scrap B & M 1908	53
15 Ballard Vale	Ballard Vale	1849, 14¼x16" 4-4-0 Scrap B & M 1876	54
Ballard Vale	Manchester	1876, 15x22" 0-4-0 Scrap B & M 1892	55
16 Essex	Essex Co.	1856, 15x18" 4-4-0 Scrap B & M 1880	56
Essex	Manchester	1880, 15x22" 4-4-0 Scrap B & M 1905	57
17 Bay State	Hinkley & Drury	1856, 14¾x20" 4-4-0 Scrap B & M 1884	58
Bay State	Mason	# 722, 1885, 17x22" 4-4-0 Renumbered 703	59
18 Granite State	Hinkley & Drury	1856, 14¾x20" 4-4-0 Scrap B & M 1887	60
Granite State	Portland	# 590, 1888, 17x24" 4-4-0 Renumbered 720	61
19 Wannalancet	Hinkley	1863, 14x20" 4-4-0 Scrap B & M 1884	62
Oak Grove	Manchester	1886, 18x24" 4-4-0 Renumbered 864	63
20 O. W. Bayley	Amoskeag	# 92, 1853, 15x20" 4-4-0 Scrap B & M 1880	64
O. W. Bayley	B & M R R	1881, 15x22" 4-4-0 Scrap B & M 1906	65
21 Rockingham	Hinkley & Drury	# 121, 1847, 15x20" 4-4-0 Sold	66
Rockingham	Rebuilt Amoskeag	# 118, 1853, 4-4-0 Scrap B & M	67
Rockingham	Manchester	1863, 15x24" 4-4-0 Sold B & M 1896	68
22 United States	Hinkley & Drury	# 172, 1848, 14x18" 4-4-0 Scrap B & M	69
United States	B & M R R	1887, 15x22" 4-4-0 Scrap B & M 1905	70
23 Thomas West	Hinkley & Drury	# 507, 1854, 16x20" 4-4-0	71
Thomas West	Rebuilt B & M R R	1880, Sold 1895	72
24 Merrimac	Hinkley & Drury	# 508, 1854, 16x20" 4-4-0	73
Merrimac	Rebuilt B & M R R	1880, 16x20" 4-4-0 Scrap B & M 1897	74
25 Atlantic	Hinkley & Drury	# 556, 1855, 15x22" 4-4-0 Scrap B & M 1889	75
Atlantic	B & M R R	1890, 17x22" 4-4-0 Renumbered 826	76
26 Pacific	Essex Co.	1856, 15x22" 4-4-0 Scrap B & M 1883	77
Pacific	B & M R R	1884, 18x22" 4-4-0 Renumbered 801	78
27 Haverhill	Hinkley & Drury	# 264, 1850, 16x20" 4-4-0 Scrap B & M 1858	79
Haverhill	Hinkley	1862, 14x22" 4-4-0 Scrap B & M 1885	80
Haverhill	Mason	# 724, 1885, 17x22" 4-4-0 Renumbered 704	81
28 Mystic	Hinkley & Drury	# 265, 1850, 16x20" 4-4-0 Scrap B & M 1882	82
Mystic	Rhode Island	#1356, 1883, 15x20" Forney Scrap B & M 1906	83
29 Newburyport	Hinkley & Drury	# 531, 1854, 14x22" 4-4-0 Scrap B & M 1891	84
		From Newburyport & Georgetown R. R.	85
Newburyport	Manchester	1892, 17x24" 4-4-0 Renumbered 785	86
30 Camilla	Hinkley & Drury	# 205, 1848, 14x20" 4-2-2 Scrap B & M 1884	87
Camilla	Mason	# 725, 1885, 17x22" 4-4-0 Renumbered 705	88
31 Andover	Locks & Canals	1836, 13¾x16" Scrap B & M 1856	89
Andover	Hinkley	1861, 15x22" 4-4-0 Scrap B & M 1884	90
Andover	B & M R R	1884, 17x22" 4-4-0 Renumbered 627	91

1876	32 Ajax	Hinkley	# 680, 1861, 15x24" 4-4-0 Scrap B & M 1882
1892	Durham	Manchester	1883, 17x24" 4-4-0 Scrap B & M 1904
	33 Hercules	Hinkley	1861, 16x24" 4-4-0 Scrap B & M 1893
	Not named	Manchester	1894, 18x24" 4-4-0 Renumbered 935
02	34 Exeter	Hinkley & Drury	1856, 15x20" 4-4-0 Sold U S M R 1863
1882	Exeter	B & M R R	1864, 15x22" 4-4-0 Scrap B & M 1885
	Exeter	Manchester	1886, 18x24" 4-4-0 Renumbered 665
1-4-0	35 Stratford	B & M R R	1865, 15 1/2 x 22" 4-4-0 Scrap B & M 1882
1895	Stratford	Rhode Island	#1357, 1883, 15x20" Forney Scrap B & M 1909
1876	36 Alton Bay	Taunton L W	# 38, 1849, 14x18" 4-4-0 Scrap B & M 1880
1902			From Dover & Winnepesaukee R. R.
1878	Alton Bay	Manchester	1880, 15x22" 4-4-0 Scrap B & M 1906
02	37 Hobart Clark	Hinkley	1866, 15x22" 4-4-0 Sold Poulterer & Co.
0	38 James Hayward	Manchester	# 83, 1866, 16x24" 4-4-0 Scrap B & M 1902
1904	39 Shawmut	Manchester	# 84, 1866, 16x24" 4-4-0
0	Rebuilt at	Manchester	1889, Renumbered 600
1891	40 Lion	Hinkley	# 815, 1867, ——— Scrap B & M 1886
1885	Lion	B & M R R	1887, 15x22" 0-4-0 Scrap B & M 1906
62	41 Gen'l Grant	Manchester	# 97, 1867, 16x24" 4-4-0 Scrap B & M 1908
1885	42 Gen'l Sherman	Hinkley	# 827, 1867, 16x24" 4-4-0 Scrap B & M 1908
63	43 Middlesex	B & M R R	1868, 16x24" 4-4-0 Scrap B & M 1905
1867	44 Dover	Hinkley	# 882, 1868, ——— Scrap B & M 1887
1887	Dover	Manchester	1887, 17x24" 4-4-0 Rebuilt 1907 and renumbered 664
1908	45 Gen'l Sheridan	B & M R R	1868, ——— Scrap B & M 1890
1876	46 N. G. Paul	Rhode Island	1878, 18x24" 4-6-0 Scrap B & M 1894
1892	47 Achilles	Baldwin	#2347, 1871, 10x14" 0-4-0 Scrap B & M 1894
880	48 Suffolk	B & M R R	1871, 17x22" 4-4-0 Rebuilt 1885 and renumbered 629
905			#1035, 1871, 16x22" 4-4-0 Sold—Cal. Lum.#2
1884	49 Machigonne	Hinkley	1872, 17x22" 4-4-0 Rebuilt 1883 and renumbered 640
03	50 North Star	Manchester	1872, 17x22" 4-4-0 Scrap B & M 1909
1887			1872, 17x22" 4-4-0 Scrap B & M 1890
20	51 Saxon	Manchester	#1067, 1872, 16x22" 4-4-0 Sold Poulterer & Co.
884	52 Titan	Hinkley	1872, 17x22" 4-4-0 Rebuilt 1885 and renumbered 641
54	53 Mercury	Manchester	1872, 17x22" 4-4-0 Rebuilt 1891 and renumbered 642
1888	54 Sachem	Manchester	1872, 17x22" 4-4-0 Rebuilt 1893 and renumbered 643
906			1872, 17x22" 4-4-0 Rebuilt 1890 and renumbered 644
1896	55 Forest City	Manchester	1872, 17x22" 4-4-0 Rebuilt 1883 and renumbered 645
	56 Francis	Manchester	1872, 17x22" 4-4-0 Rebuilt 1886 and renumbered 646
1905	Cogswell		1873, 17x22" 4-4-0 Scrap B & M 1908
	57 Minerva	Manchester	1873, 17x22" 4-4-0 Rebuilt 1890 and renumbered 647
897	58 Wm. Merritt	Manchester	# 462, 1872, 17x24" 4-4-0 Scrap B & M 1882
1889	59 Columbia	Manchester	1883, 17x24" 4-4-0 Scrap B & M 1906
6			# 463, 1872, 17x24" 4-4-0 Rebuilt 1887 and renumbered 700
883	60 Pepperell	Manchester	# 467, 1872, 17x24" 4-4-0 Rebuilt 1887 and renumbered 701
1	61 Old Orchard	Manchester	# 469, 1872, 17x24" 4-4-0 Scrap B & M 1906
858			Scrap B & M 1891
885	62 Cumberland	Mason	#1147, 1873, 14x22" 0-4-0 Scrap B & M 1894
882	Cumberland	Rhode Island	1873, 14x22" 0-4-0 Scrap B & M 1894
1906	63 Transport	Mason	#1151, 1873, 14x22" 0-4-0 Scrap B & M 1898
191			1874, 16x22" 4-4-0 Scrap B & M 1908
R.	64 Wm. Merritt	Renamed	
5	Pilot	Mason	
1884	65 Samoset	Mason	
6	66 Decatur		
186	67 Comet	Hinkley	
184	68 Casco	Hinkley	
7	69 Escort	Hinkley	
	70 J. C. Ayer	Manchester	

71 South Berwick	Manchester	1874, 16x22" 4-4-0 Scrap B & M 1908
72 Lowell	Manchester	1874, 16x22" 4-4-0 Scrap B & M 1908
73 Saco	Manchester	1874, 17x24" 4-4-0 Rebuilt 1887 and renumbered 648
74 S. A. Walker	Manchester	1876, 17x24" 4-4-0 Rebuilt 1896 and renumbered 665
75 Malden	Manchester	1876, 16x24" 4-4-0 Rebuilt 1895 and renumbered 752
76 Melrose	Manchester	1876, 16x24" 4-4-0 Rebuilt 1895 and renumbered 753
77 Wakefield	Manchester	1877, 16x24" 4-4-0 Rebuilt 1895 and renumbered 754
78 Eagle	Manchester	1879, 15x22" 4-4-0 Scrap B & M 1905
79 Bradford	Manchester	1879, 15x22" 4-4-0 Scrap B & M 1905
80 Danvers	Hinkley	1879, 15x22" 4-4-0 Scrap B & M 1903
81 Biddeford	Manchester	1880, 17x24" 4-4-0 Rebuilt 1896 and renumbered 666
82 Everett	Baldwin	\$5307, 1880, 14x18" dummy Scrap B&M 1905
83 Somerville	Manchester	1880, 15x22" 0-4-0 Scrap B & M 1904
84 Arlington	Manchester	1880, 15x22" 0-4-0 Scrap B & M 1905
85 Camp Ellis	Baldwin	\$4161, 1877, 14x18" dummy Scrap B&M 1892
86 Bay View	Grant	\$1185, 1878, 9x14" 0-4-0 Renumbered 2nd #3 Sold 1902 now in service on East Carolina R. R.
87 Newton	Manchester	1882, 15x22" 4-4-0 Scrap B & M 1906
88 Kingston	Manchester	1882, 15x22" 4-4-0 Scrap B & M 1906
89 Atkinson	B & M R R	1882, 17x24" 4-4-0 Scrap B & M 1900
90 Plaistow	B & M R R	1883, 17x24" 4-4-0 Renumbered 631
91 Kennebunk	B & M R R	1883, 17x22" 4-4-0 Scrap B & M 1904
92 Madbury	Manchester	1883, 17x24" 4-4-0 Scrap B & M 1907
93 Wilmington	Manchester	1884, 18x22" 4-4-0 Rebuilt 1905 and renumbered 860
94 Newmarket	Manchester	1884, 18x22" 4-4-0 Renumbered 861
95 Methuen	B & M R R	1886, 15x22" 0-4-0 Scrap B & M 1906
96 Bollingsford	Rhode Island	1884, 17x24" 4-4-0 Scrap B & M 1910
97 Gen'l Meade	Portland	\$ 558, 1887, 18x22" 4-4-0
Rebuilt	Manchester	1906, Renumbered 842
98 Lawrence	Portland	\$ 559, 1887, 18x22" 4-4-0
Rebuilt	Manchester	1909, Renumbered 843
99 Hinkley	Portland	\$ 560, 1887, 18x22" 4-4-0
Rebuilt	Manchester	1906, Renumbered 844
100 Mathew	Mason	\$ 746, 1887, 15x22" Forney Renamed Crad-
Craddock		dock. Scrap B & M 1906

The engines that follow came from the Eastern R. R. and they will appear in the next bulletin. Let me close by saying that in producing this material there is no other motive than to present the work of the late Herbert P. Yeaton. The data submitted from the Annual Reports of the Boston & Maine R. R. and the locomotive builders must be correct. On the other hand if Mr. Yeaton erred in 1911, some of these errors I have tried to correct and if there are any others that remain, letters from our members will be welcome.

(The photographs that accompany this article were loaned through the kindness of Mr. J. W. Merrill).

Pioneer Experience in Electric Traction and The New Haven Railroad

By SIDNEY WITHINGTON



UCH of the early electric traction experience in New England is intimately connected with the New Haven Railroad, either directly or through organizations which subsequently became part of the railroad. New Englanders have been active in developing this art from its earliest infancy. A number of individuals working independently of one another had experimented in the application of the electric motor for traction purposes, and in the half decade between 1885 and 1890 electric traction progressed from the laboratory stage to commercial practicability.

In 1887, in the Towns of Derby, Ansonia and Birmingham, three contiguous manufacturing communities on the Naugatuck and Housatonic Rivers, a group of men who were interested in a horse railway decided to avail themselves of the opportunity to try the new form of motive power, and bought the electric facilities complete from the Van Depoele Electric Manufacturing Company, one of the three companies then engaged in the manufacture of electric traction equipment. The Ansonia, Derby and Birmingham Electric Line, opened in May 1888, was the first such installation in New England.

The rolling stock of this line consisted initially of three electric passenger cars and one freight electric locomotive. Each of the passenger cars was equipped with a twelve horsepower motor, mounted on the front platform (it was replacing horses) and driving the car by means of sprocket and chain. The cars were built by the J. G. Brill Company, which is still engaged in this kind of work. Although it was not for some time thought generally necessary to protect the drivers from the weather, it was found desirable in this instance to protect the motor, and the cars were thus equipped with front vestibules. They were designed for single direction operation only, and it was thus necessary to turn them at the end of each trip. The voltage in the trolley wire was 500 volts—about the same as for trolley car operation today.

The electric locomotive purchased for this line was the most interesting portion of the equipment, for it was undoubtedly the first electric freight locomotive to be operated commercially in this country. This pioneer locomotive was equipped with a seventy-five horsepower bi-polar motor (a notably large motor for the period) mounted in the center of the cab and driving both of the two axles by means of a pinion and gear, a jack shaft and chains and sprockets; a double reduction. The unit was operable in either direction, and was provided with two sets of brushes arranged tangentially for this purpose—one pair for operation in one direction and the other pair in the opposite direction.

Instead of being supplied with a set of resistance grids for control, as is the custom nowadays, the locomotive was equipped with leads brought out from the field windings in such a way that the supply current passed through a varying number of turns and thus produced varying field strength; the field coils acting also as a rheostat. The

brushes were of laminated copper, and each pair was thus mechanically as well as electrically operable in but one direction. It is said that the engineman's equipment included a pair of tin-smith's shears which were not infrequently called into service on account of back-lash when the locomotive stopped, if the brushes were not properly raised from the commutator. This pioneer locomotive is still in existence (though not in operable condition)—an historical relic of very considerable interest as a reminder of the earliest days of electric traction in this country. The name of the builders of the cab, the Pullman Company, is prominently displayed on the journal pedestals. The general appearance of the locomotive is clearly indicated in the illustrations, which show the arrangement of the motor, trolley pole equipment, etc. The low roof was necessary on account of limited clearance under a bridge on the route.

In the cities of Hartford and Meriden, Connecticut, there was also very early activity in electric traction. In each of these cities the managements of the horsecar lines were quick to see the advantages of electric operation, and electric cars were first operated in Meriden in July 1888, and in Hartford in September of that year, but a few months after the inauguration of the Derby operation.

It is of interest to note that the three concerns engaged in the manufacture of electric traction apparatus, Van Depoele, Daft, and Sprague, installed respectively the three earliest electric railways in Connecticut. While the Van Depoele installation was proceeding at Derby and Ansonia, the Daft System was in process at Meriden and the Sprague at Hartford. The urban traction operations in each of these cities are now performed by The Connecticut Company, a subsidiary of the New Haven Railroad.

The origin of the term "trolley car" which still persists, may be readily seen in the accompanying illustration of the first Meriden electric car. The power was collected by means of a veritable *trolley* mounted upon the wires over the tracks and towed along by the car. Although this method of current collection was very soon discarded in favor of the now common under-running pole and wheel, the term "trolley" still persists.

The development of urban and interurban electric railroads in New England following the pioneer installations was very rapid, and it became apparent to the Management of the New Haven Railroad that the application to steam railroad operation of this new form of traction would be desirable from many viewpoints. On June 30th, 1895, in pursuance of this policy, electric operation was substituted for steam operation on the Nantasket Beach Branch of the New Haven Road, from Nantasket Junction to Pemberton, Massachusetts, over about nine miles of double track route. This operation is worthy of note, as it was the first example of electric power applied to steam railroad operation in this country, antedating by a few months the electric operation of the Baltimore Tunnel of the Baltimore & Ohio Railroad.

The power distribution of this pioneer Nantasket Beach Branch electrification was by means of an overhead contact wire of 330,030 c.m. cross section, weighing about a pound per foot. The section was a figure "8" with the lower side somewhat flattened, rolled especially for

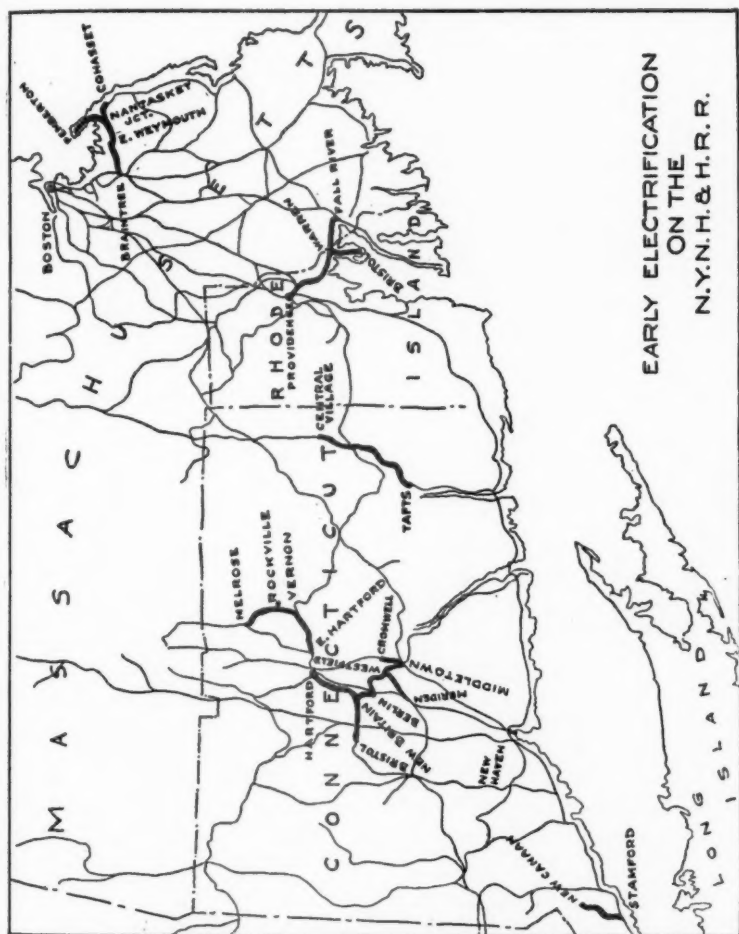


FIG. 1
Map Showing Early Electrified Sections of the New Haven Railroad, Previous to 1906.

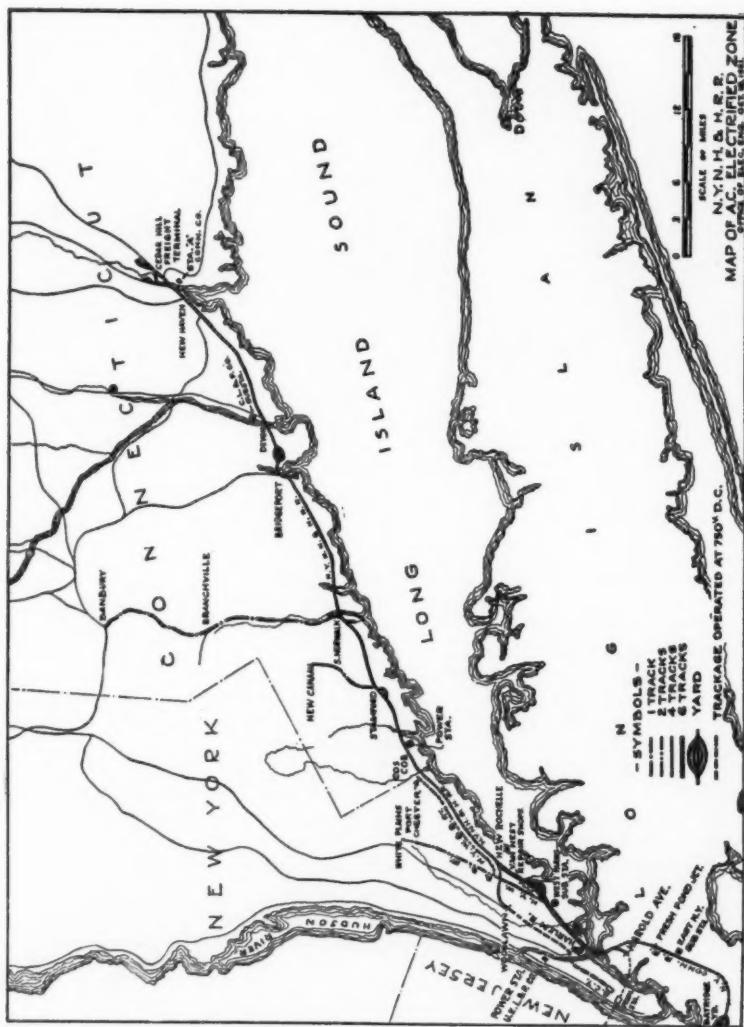


FIG. II
Map Showing Electrification of the New Haven Road and Connections Between New York and New Haven, Conn.



FIG. III

First Electric Cars in New England. Two Cars of the Ansonia, Derby and Birmingham Line, May 1888. Note the Single-End Design, Front Vestibules and Trolley Pole Rigging.



FIG. IV

Early Electric Car in Meriden, Conn.—Initial Operation July 1888. Note "Trolley" for Current Collection and the Hanger for the "Trolley Wires". This System Was installed by the Daft Company.

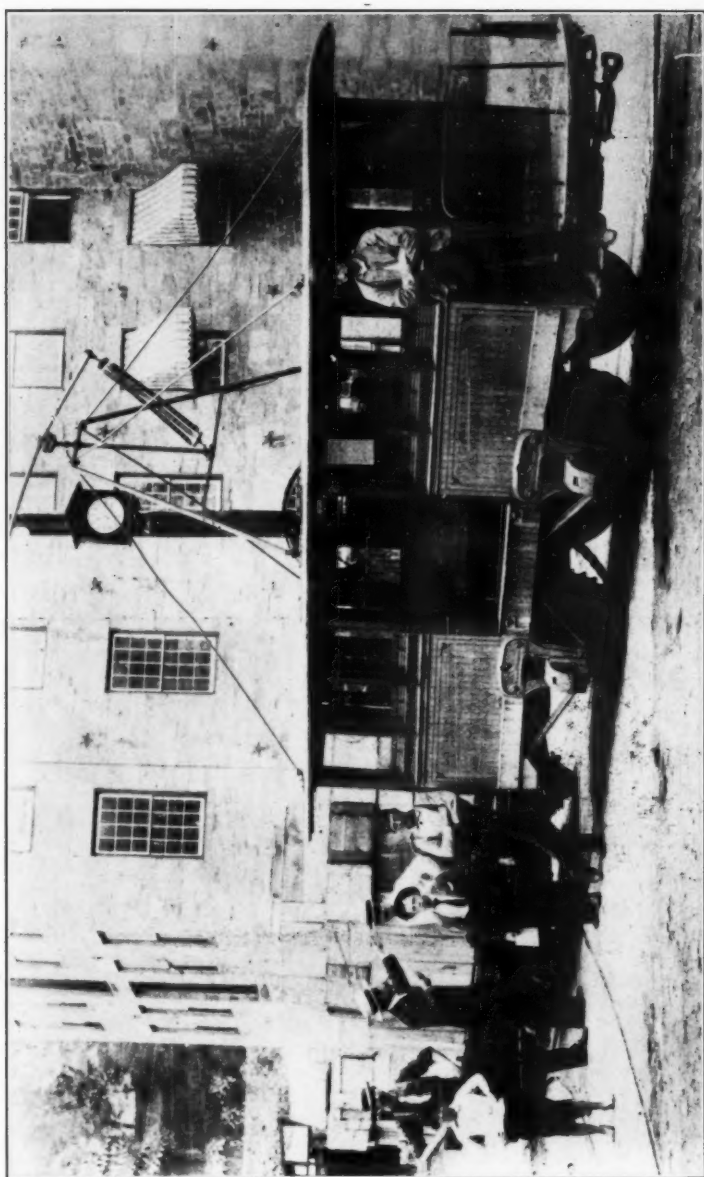


FIG. V

First Electric Freight Locomotive in the United States: Ansonia, Derby and Birmingham Line, 1888. Note Chain and Sprocket Drive, Arrangement of Motor, and Trolley Pole Rigging.

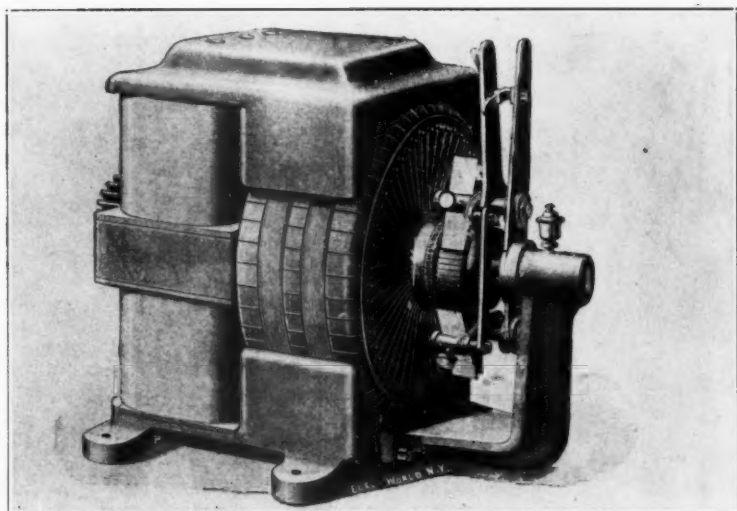


FIG. VI

Motor of the Type Used on the Pioneer Freight Locomotive, Ansonia, Derby and Birmingham Railway, Showing Brush Rigging, etc.



FIG. VII

Bi-Polar Motor of Pioneer Electric Freight Locomotive, Ansonia, Derby and Birmingham Line. Note Taps from Field Coils, Pinion and Gear and Sprocket, and Brake Handle.

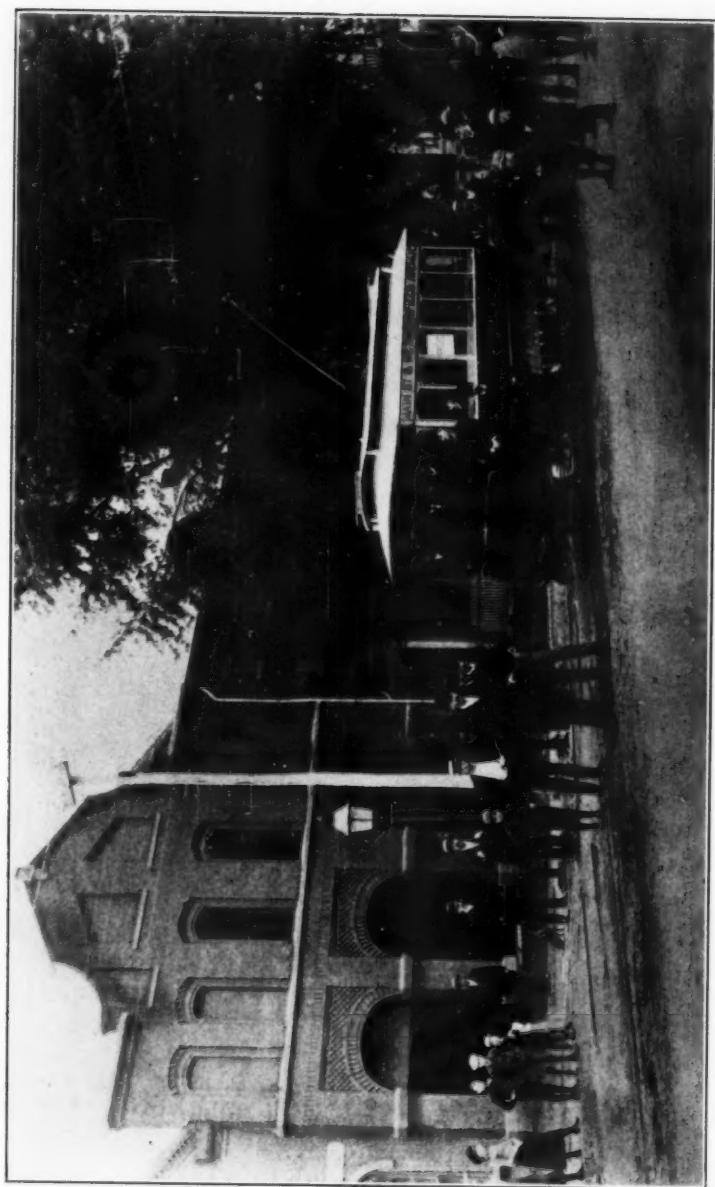


FIG. VIII

Official Trip of First Electric Car in Hartford, Conn., September 12th, 1888. This System was installed by the Sprague Company.



FIG. IX

Manufacturers' Railroad Locomotive, New Haven, Conn. This Locomotive Created Much Comment When it Was Exhibited at the Chicago World's Fair, 1893.

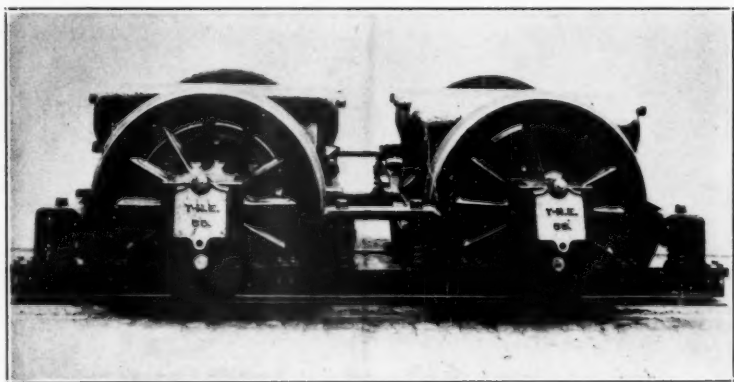


FIG. X

Truck and Bi-Polar Motors of Manufacturers' Railroad Locomotive, New Haven. Built by Thompson-Houston Electric Company, 1893.



FIG. XI

Nantasket Beach Trolley Wire and Feeder Construction. Note Sawed Pine Poles and Absence of all Insulators.

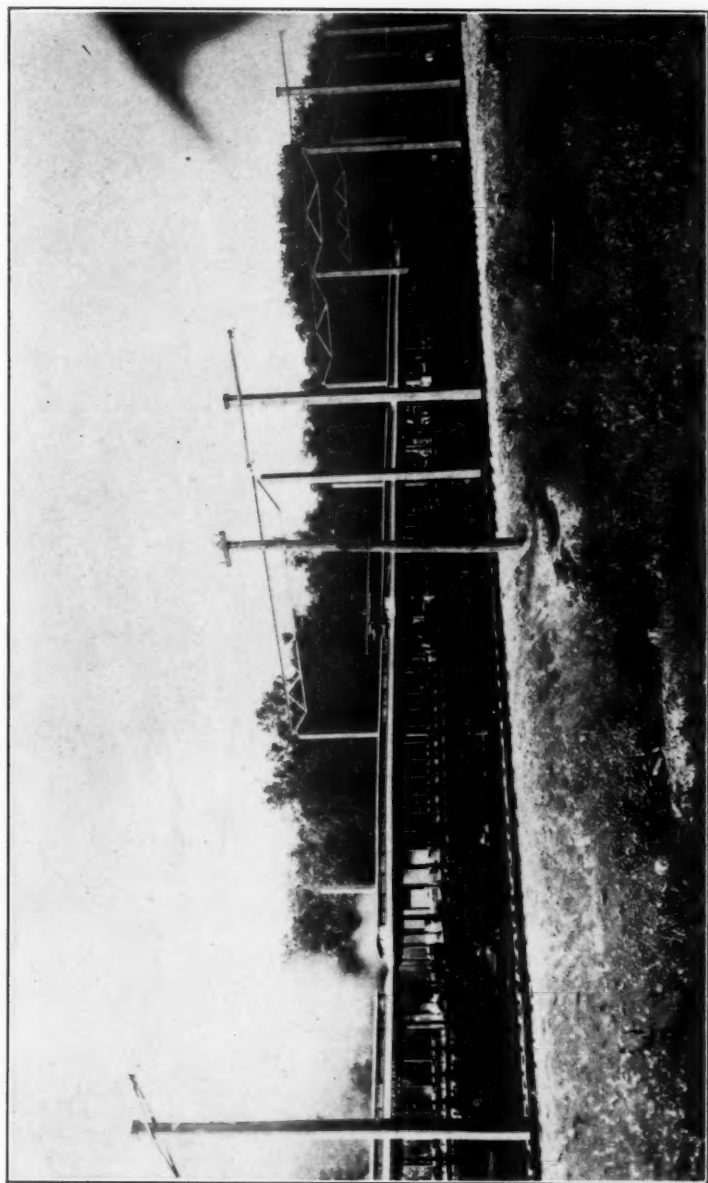


FIG. XII

Motor Car and "Open" Trailer Cars, Nantasket Beach Line, First Steam Railroad Electrification in the United States, 1895. Note the support of the Trolley Wire and feeders without insulators on wooden poles.

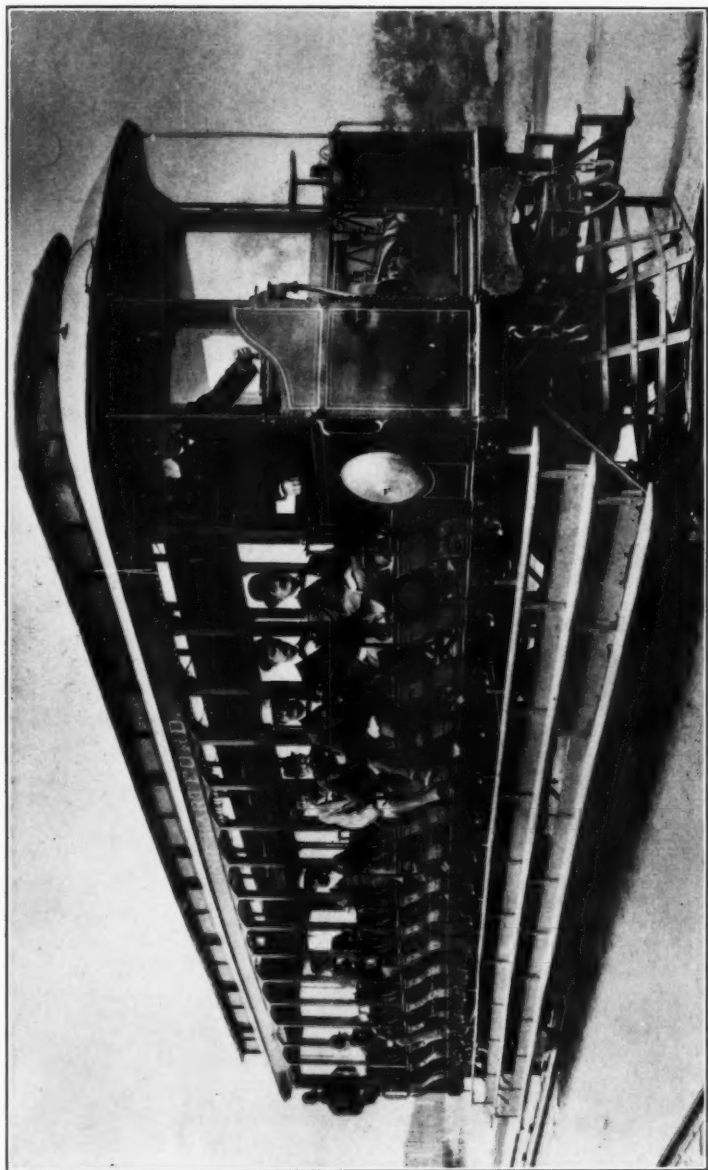


FIG. XIII

Electric Motor Car and Third Rail Installation on Early New Haven Electrification, 1896. Note the third rail between the running rails.



FIG. XIII A

East Hartford Electrification. Early Example of "Catenary Construction."

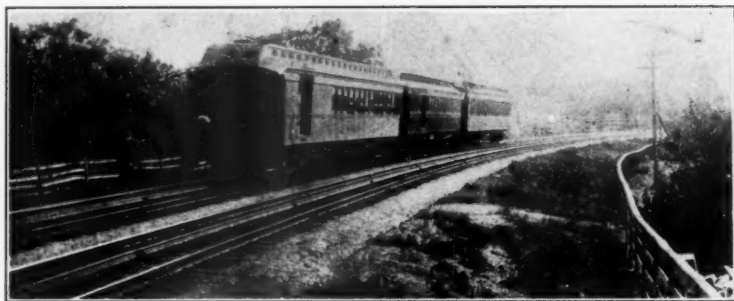


FIG. XIV

Electric Train and Third Rail on the New Haven Road between Berlin and New Britain, Conn., 1897.

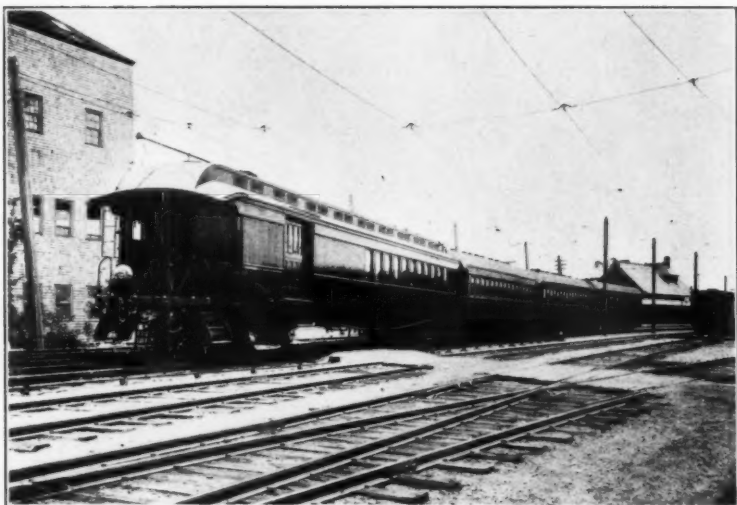


FIG. XV
Electric Train Leaving the New Haven Railroad Station at Braintree, Mass., 1898.

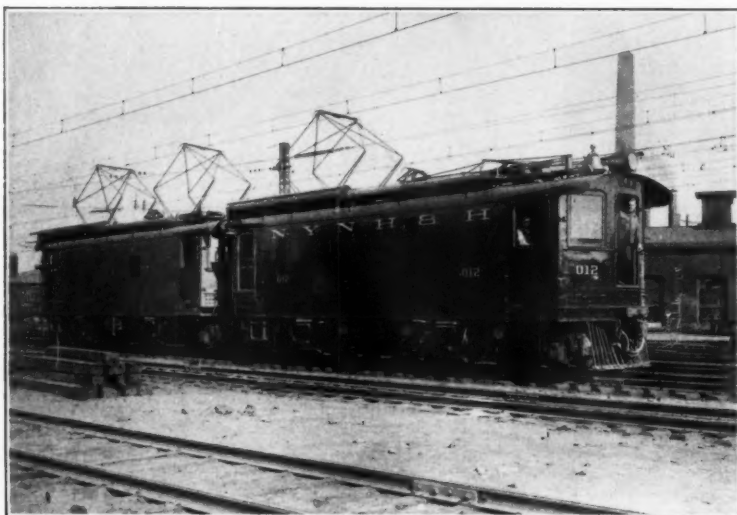


FIG. XVI
Original Type of Electric Passenger Locomotives, New Haven Road, Built 1906. Equipped for taking power from overhead contact wire at 11,000 volts alternating current or from third rail at 600 volts direct current. These locomotives have traveled more than a million and a half miles each, during their nearly twenty-five years of continuous service.



FIG. XVII

Modern Electric Freight Locomotives on the New Haven Road.

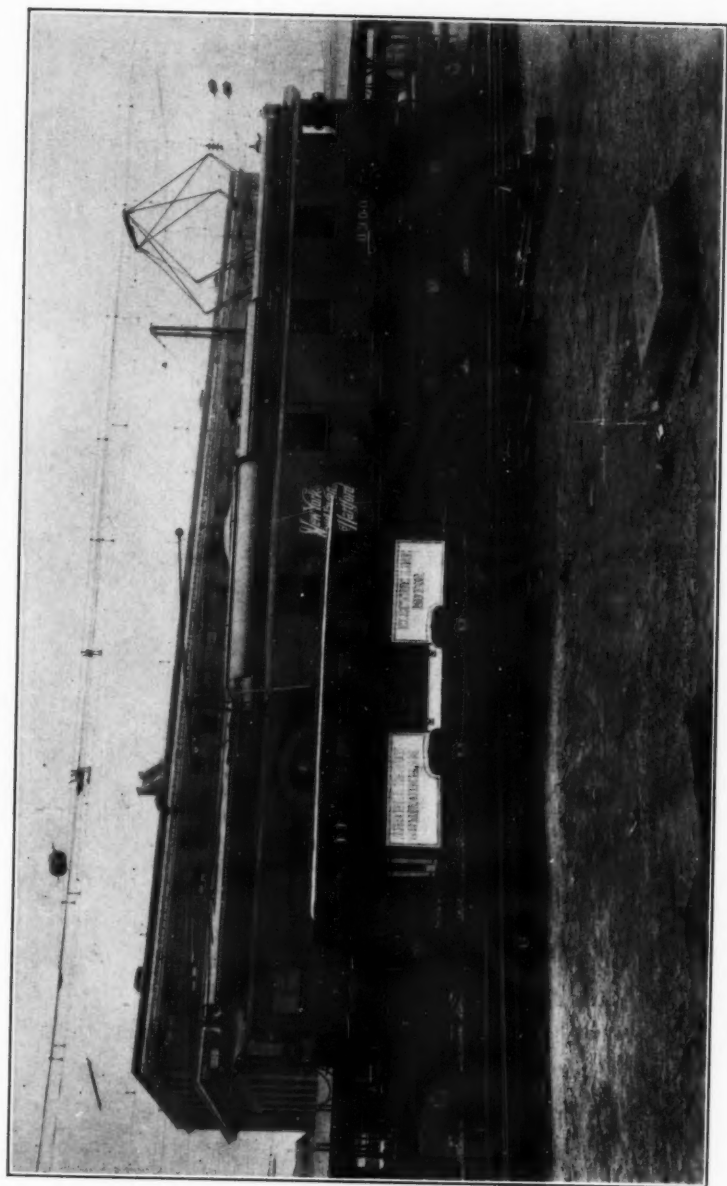


FIG. XVIII

First Electric Freight Locomotive and Modern Passenger Electric Locomotive on the New Haven Railroad.

this work by the J. E. Roebling Company, well known builders of the Brooklyn Bridge. Much of this wire is still in service. The wire was directly suspended from double brackets as indicated in the illustration, the poles being between the tracks, which were spaced on fifteen foot centers. The poles were sawed, hard pine, 12"x14" at the butt and 10"x12" at the top. They were set in concrete. The brackets consisted of two pieces of 2"x3" angle supported by 1/2" round iron truss rods through a cast iron cap at the top of the pole. The feeders were supported on this cap in grooves, without insulation other than that of the wood pole itself, as indicated in the illustration. They operated in this manner for some time.

The power for this operation was furnished from a power plant which was installed near Nantasket Beach especially for this service, by two tandem compound Greene engines operating at 110 R.P.M. and rated at 1420 horsepower each. The generators were rated at 500 KW each and the station voltage was nominally 700 volts. This steam plant was operated until 1920, when it was discontinued and power purchased from the Weymouth Light & Power Company. The building is now a substation.

The original rolling stock consisted of ten motor cars, six "open" and four "closed", and a number of trailers. Each motor car weighed 60,000 pounds and was designed to handle three or four trailers, each weighing 43,000 pounds. Much of this equipment is still in service.

The Annual Report to the New Haven Stockholders for the year 1895, in referring to this electric operation, contains this statement:

"The experiment has demonstrated that power generated in a stationary plant and transmitted by electrical energy can be successfully used in the operation of a standard railroad. The current expenses for fuel indicate that this result is economically obtained.

"The use of the existing power station will be extended presently and it is probable that electricity will be promptly adopted by the company at other points on its lines * * * and it is to be hoped without the use of an overhead trolley."

The idea of third rail distribution of power had long been in the minds of the New Haven Management and third rail was employed for the second step in the Nantasket Beach Branch electrification, undertaken on July 26th, 1896, when electric operation was extended about three and a half miles to East Weymouth, Mass. This extension was the first instance in the history of American surface railroads wherein power was distributed by means of a third rail. The third rail employed was in the form of a flattened "A" and weighed 93 pounds per yard. It was installed midway between the running rails. The shape was designed to shed water and protect the wood blocks which supported it. The top of the rail was one inch above the plane of the top of the running rails, and its lowest point 1 5/8 inches above the ties. The contact surface was thus high enough to allow the collector shoes to clear the rails at turnouts, crossovers, etc., but not high enough to foul steam locomotives and other equipment which necessarily operated over the electrified tracks.

In December, 1896, work on the electrification of another section of the steam railroad was started, between Hartford and New Britain, Connecticut (9.3 miles) and between New Britain and Berlin, Connecticut (3 miles)—a total distance of 12.3 miles. The power plant for this electrification was built at Berlin, and equipped with two 1200 horsepower direct connected cross compound engines driving at 100 R.P.M. ten-pole generators rated at 850 KW each operating at 600 volts. The same type of third rail was employed as between Nantasket Junction and East Weymouth mentioned above. Storage battery substations were installed at New Britain, Forestville, and under the station platform at Hartford. The buildings are still standing.

The trains on this section were normally made up with two cars each seating ninety-six passengers. The forward car was always the motor car, but both cars were equipped with collector shoes, not only to bridge gaps in the third rail at switches and highway crossings, but to provide for possible loss of a shoe.

The next electrification of a section of the New Haven tracks occurred in 1898, when the New Britain electrification was extended to Bristol, Conn.—a distance of 8.8 miles. This was all on the basis of third rail power distribution. Although the steam railroad was double track in this section, but one track was electrified.

At about this time (1898) also the Nantasket Beach electrification had been extended from East Weymouth to Braintree, Mass. 4.4 miles of double track. This was also on the basis of third rail construction. In 1899 the electrification was extended from Nantasket Junction to Cohasset, Mass.—about 3.4 miles.

The steam road branch between Stamford and New Canaan, Conn.—a distance of about 8 miles—was also electrified at about this time. This branch was equipped with an overhead trolley to allow interchange with the local street railway equipment. The power plant was located at Stamford and was equipped with two Greene single non-condensing engines direct connected to 300 KW generators. In 1908, after the main line had been electrified from New York to Stamford, the New Canaan Branch was reconstructed and catenary installed to replace the old direct suspension trolley wire. Insulation for eleven thousand volts was installed and standard main line equipment was thus enabled to operate to New Canaan.

In the meantime, the Manufacturers Railroad, which had been organized by a group of manufacturers in New Haven, Conn. to facilitate delivery of freight, had been acquired by the New Haven. This road had been originally operated by horses which took the freight cars from the interchange tracks and hauled them along the right-of-way of the Manufacturers Railroad and through city streets to the delivery points. The road at that time was about two and a half miles long and contained grades as high as $2\frac{1}{2}$ percent.

In 1896 a thirty ton locomotive was purchased for operating the Manufacturers Railroad electrically. This locomotive, built by the Thomson-Houston Company (since consolidated with the General Electric Company) at Lynn was noteworthy as the first electric locomotive of any considerable size to be built. This locomotive had created a great deal of interest and comment when it was exhibited at the Chicago

World's Fair in 1893. It had marked an epoch in electric traction and its purchase for operation in New Haven is a typical example of New England's pioneer spirit in the electric traction field.

This locomotive was provided with two bi-polar motors, each motor mounted direct upon one of the two axles, without gears. The engine had a drawbar pull of 7,000 pounds, overall length of 16'6", and a wheel base of 5'6". The two pairs of drivers were 44 inches in diameter; the two gearless motors drove the locomotive through quills. Power was taken at 600 volts from an overhead trolley wire.

In 1901 the Providence, Warren and Bristol Branch was electrified by the New Haven from Providence to Bristol, R. I. and Fall River, Mass. This carried very heavy interurban service and was one of the notable electrifications of its time. The power plant was located near Warren and originally contained the two 850 KW 625 volt generators directly connected to two cross compound Greene engines which had been originally installed in the Berlin plant. An interesting feature of this plant was the use of steam jets in injecting into the combustion chambers, cinders which had been removed from the front ends of the railroad's steam locomotives. The cost of fuel thus burned was, therefore, only the expense of hauling the cinders to the power plant. This may be said to have been an early forerunner of the now common use of pulverized fuel.

Two storage battery stations, each of 250 cells, 800 ampere-hour capacity, were originally installed at East Providence and at Brayton, R. I., respectively, to assist on peak loads. The power distribution on the P. W. & B. Branch was by means of an overhead trolley wire of 4/0 copper directly suspended from cross-spans or pole brackets. The motor cars were each equipped with four eighty horsepower motors.

In 1905 two steam turbine generators (a then very recently developed type of prime mover) were installed at Warren, and transmission at 13,200 volts to rotary substations at Brayton and East Providence accomplished.

The lines from Berlin to Middletown and between Meriden and Westfield; Middletown and Cromwell; and Tafts and Central Village, all in Connecticut, were electrified in 1906. In 1907 the tracks from East Hartford (Burnside) to Vernon, Rockville and Melrose, were also equipped for electric operation. All of these installations were on the basis of 600 volt direct current, with an overhead trolley wire. Catenary construction was employed on the Burnside-Vernon section.

Owing to changes in transportation demands during the last twenty-five years, the service on nearly all the electrified sections described has been abandoned entirely or very much reduced. Nevertheless, the experience gained undoubtedly justified the efforts expended.

Allowing all due credit to the early pioneer development in the field of electric traction by the New Haven Railroad, the most notable accomplishment in this direction has been without doubt the main trunk line electrification between New York and New Haven. This was inaugurated in the suburban territory between New York and Stamford in 1907 as a result of legislation by the State of New York which proscribed operation by steam in the Park Avenue Tunnel of New York City. The New York Central Railroad, which was responsible for the

operation over the tracks between Woodlawn, N. Y. and the Grand Central Terminal over which the New Haven passenger trains operate, chose to install a third rail system at low voltage. That system had been highly developed in rapid transit service and there is no doubt that the choice was justified from a conservative standpoint.

The New Haven engineers, having a background of experience over scattered sections as outlined above, with both third rail and overhead contact distribution of direct current power at low voltage, chose the so-called "single-phase" system of distribution with the trolley energized at 11,000 volts. They recommended this in spite of the added complication due to the necessity of operating over the New York Central tracks taking power from the third rail (which meant that the New Haven locomotives carried virtually double equipment) and in spite of the fact that there was at that time extremely limited experience with the single phase system which could be used as a guide. The New Haven officers looked forward to electric operation of freight service as well as passenger service, and to very considerable future extensions of the electrified territory, and they recognized the serious limitations set by low voltage power distribution.

This choice of single phase by the New Haven has fully justified itself from all points of view, and this system has been adopted as standard for many of the leading electrification projects, both in this country and abroad. The New Haven has for many years been the only railroad on which all branches of service have been electrically operated—suburban and "through" passenger service, freight and yard switching. The electrified territory has been extended to Harlem River, N. Y., to New Haven and to Danbury, Conn.; and to Bay Ridge and Sunnyside Yard, New York over the New York Connecting and the Long Island Railroads. It also includes the New York, Westchester & Boston Railroad.

A number of original developments, as might be expected, have been made in connection with this New Haven main line electrification, many of which have been subsequently adopted by other railroads. Included in this category among a number of items may be mentioned the use of "H" rolled section poles for catenary support, the "inclined catenary" which allows the contact wire to run parallel to track curves, the use of an auxiliary trolley, flexible ratio motor-generator frequency changers, balancing transformers, and the "three-wire" system of power distribution, step-up balancing transformers for raising the trolley voltage, booster transformers in series with the trolley circuit, high speed oil circuit breakers, and in connection with a local street railway load, the use of static mercury arc rectifiers.

These brief notes are written with the idea of indicating the pioneer work accomplished from the start by the New Haven Railroad and its associated companies in the field of electric traction, leading up to the installation of what is, just at present, without doubt the most comprehensive electrified railroad operation in this country. Acknowledgment is made for photographs reproduced herewith to Messrs. C. R. Harte, H. F. Brown, J. F. Vaughn, W. B. Potter, S. H. Barnum and the General Electric Company.

Some Notes Concerning Old Locomotive History

By F. GAISER



HAVING read during the last thirty-five years all the more important books on locomotive matter, especially locomotive history, and having reflected much upon the inaccuracies, contradictions and exaggerations which are frequently met with in this kind of literature, I intend now to publish some results of these reflections in an interesting series of articles. It is not my intention to have the last word in any of the matters to be dealt with, merely to give an impulse of thought. If any of the readers of these lines be able to contribute something of his own, he is invited to do so for that is the purpose of every historical society.

Beginning with the oldest locomotive worked passenger railway in the World—the Liverpool & Manchester Railway—I wish to state, that in my opinion, the engraving of a Planet type locomotive published on page 83 of Dendy Marshall's book, "Centenary History of the Liverpool & Manchester Ry." (from a little-known booklet of 1832 noted on page 144 of Marshall's book) is by far the best representative of the 2-2-0 type of engine ever published. Hitherto the most published picture was a reproduction from Pambour's—"Traité des Machines Locomotives", (Paris 1835 and 1840). Although that eminent and scrupulous author states himself that the figures joined to his work and made on his own sketches were only to facilitate the intelligence of the letterpress and were quite imperfect for any other purpose. The original of the engraving on page 83 of Marshall's book appears to have been made very accurately to scale. The wheels are 5' and 3'-6" in diameter. The boiler is 6'-8" long and the firebox is very short. According to the lists given by Wood and Whishaw, there were at the end of 1832 only two engines with carrying wheels of 3'-6". These were the "Pluto", No. 27 and "Ajax", No. 29. All the others had 2'-9" or 3'-0" wheels. The same authorities give the lengths of boilers (and inner firebox) of "Pluto" and "Ajax" as 7'-9" and 6'-8" (2'-0½" and 1'-8½") respectively. There can scarcely be any doubt that the engraving in question represents the "Ajax". According to Mr. Marshall, this engine was put to work in November, 1832.

As for Pambour's sketches, they fail clearly in some particulars. Such details of horn-plates, shape of chimney top, absence of steam pipes for the exhaust from safety valves, absence of firebox roof staying, etc., but the appearance of the engine as a whole is so harmonious that there is no room for arbitrary drawing. This sketch also must have been made to scale. A superficial examination of the several figures published by Warren on page 277 shows that the driving wheels are 5' in diameter whereas the boiler barrel which contains 76 tubes measures 3' by 6'-6". The only engine in Whishaw's list to which these dimensions and the number of tubes correspond is the "Mars"—as originally built. The dimensions of the inner firebox of this engine as given by Whishaw

were: length 1'-10", width 3'-6", height above bars 3'-11½". These agree very closely with Pambour's sketch. There is, it is true, a difference in the diameter of the leading wheels, which were according to Wood and Whishaw 3'-0", but are 3'-4" in Pambour's sketch. This difference is due either to inaccurate sketching or to the old fore wheels having been replaced by new ones. Leading wheels often broke and there was a tendency to replace them with larger ones. The "Mars", No. 12, together with the "Mercury", No. 11, was the immediate successor of the "Planet", and according to Mr. Marshall was delivered as early as January, 1831. That the engine sketched by Pambour must be of an earlier date than the "Ajax" is clearly denoted by the fact that in the former, the first of the brackets supporting the boiler is placed *behind* the smokebox in the same manner as in the "Planet" or in the "St. Rollox" of the Glasgow & Garnkirk Railway. See Warren, page 270 upper picture and also drawing on page 257. In later engines of the 2-2-0 type this bracket was fixed on the smokebox as it was in the case from the outset in all 0-4-0 or "Samson" type engines, the large front wheels in the latter preventing a bracket to be fixed immediately behind the smokebox. Apparently the latter mode proved more satisfactory. The steam dome of Pambour's engine is located on the firebox, while that of the "Ajax" stands on the front part of the boiler barrel. This also confirms what we have stated about the dates of the two engines for the first named position of the dome preceded the other and will be found in all Liverpool and Manchester engines from the "North Star", No. 7 down to the "Atlas", No. 23. (Warren page 280, first drawing; the piston valves identify this engine as the "Atlas". See also The Engineer, Sept. 24th, 1926, page 330). If our identification of the "Ajax" is correct, this engine appears to be one of the first with the forward dome. At any rate, it is older than the engine represented by the drawing at the bottom of page 280 of Warren's book. For this latter engine, by means of dates and dimensions, given by Wood and Whishaw, can easily be traced as the "Thomas Newcomen" of the Stanhope & Tyne Ry. Its Maker's number, according to Wood, was 31. Whishaw gives the date as 1834. The engine may however, have been built in 1833 and not begun regular service until 1834.

The forward dome of moderate size was used for several years by Stephenson & Co. in engines of every description—2-2-0, 2-2-2, 0-4-0 and 0-6-0, until 1837. Then they made a radical departure for a dome of considerable larger size and put it either a little farther back than before (see "La Victorieuse", and Alais & Beaucaire Ry. 2-2-2, Warren, page 324) or in the very middle of the boiler barrel as on the "North Star", "Morning Star" of the Great Western Ry. Towards the end of 1838 the evolution ended in the haystack form of dome.

It is interesting to note that the two drawings of Stephenson engines which differ from the evolution traced—an engine for an American Ry., Warren page 305 and the pseudo "Harvey Combe", Warren, page 318,—are both something of a problem. The boiler mountings shown in the latter drawing constitute an anachronism for an engine of 1837 and even of 1835. Fortunately the proper form of the "Harvey Combe", is now secured by Plate LXXVIII of Simm's—"Public Works

of Great Britain", 1838, thanks to Mr. Warren's discovery (see The Engineer, Sept. 24, 1926, page 330). I wish to add here that 2-2-2 Patentee type engine published in Pambour's *Traite*, second edition, Paris 1840, refers no doubt to the same engine—Simm's drawing. It is not the same stereo but as will be noted by certain minor alterations such as the excessive curvature of the upper part of the hand gear levers, have been drawn over again by Mr. Pambour. He gives it as an engine of the Liverpool & Manchester Ry., assuming it to be representative of the most successful type of engine then running on that road.

In John Rastrick's notebook, published in Marshall's Liverpool & Manchester book, there is the following entry under date of Feb. 20, 1830. (See page 185): "The last engine Mr. Stephenson tried was called the 'Wildfire' and this had 90 tubes". Mr. Marshall's notes thereto—"The 'Wildfire' must have been either the one afterwards called 'Meteor' or the 'Arrow', probably the latter. The precise number of tubes in these engines was 88." The figure 88 is no doubt taken from Warren's summary note on page 232 of his Stephenson book, but both Wood and Whishaw record that the engines in question as originally built had, the former 88 and the latter 90 tubes. From this, it would result that Rastrick's figure of 90 is correct and that the "Wildfire" was in fact identical with the "Arrow", as assumed by Mr. Marshall.

In the locomotive list of Marshall's book on the Liverpool & Manchester Ry., pages 75-77, Sharp's "Experiment", No. 32 is tabulated with cylinders $13\frac{1}{2} \times 16$ ", a ? being added to the ciphers. Now, from a classification of cylinder dimensions given on page 32 of Pambour's *Traite*, 1835, it can easily be deduced that the cylinders of the "Experiment" were 11×16 " and the same figures are given by Whishaw.

In The Locomotive, 1926, page 44, the question is raised how Stephenson & Co., in constructing the celebrated "North Star", broad gauge engine for the Great Western Ry. in 1837, came to the unusual proportions of the cylinders, 16×16 ". I doubt if American requirements had anything to do with it. The short stroke engine was highly spoken of with regard to speed on the Liverpool & Manchester Ry. and speed was what Mr. I. K. Brunel and the directors of the Great Western Ry. were interested in just then. It is unknown whether the two engines, "North Star" and "Morning Star", had, as originally built for the American 6'-6" gauge railway, other cylinders with a longer stroke. At any rate Mr. Warren on page 340 of his book suggests that many alterations, especially on the "North Star", were made in adapting this engine to the 7'-0" gauge.

There were additional short-stroke cylindered engines of the 2-2-2 type built for the Great Western Ry., of which two having 14×14 " cylinders with 7'-0" driving wheels are noteworthy. They were built by Mather, Dixon & Co., Liverpool, who had also built four short stroke engines for the Liverpool & Manchester Ry. To judge from the builder's numbers of the two Great Western Ry. engines (40 and 41 against 50, 51 and 52), they were the earliest of the six engines which were delivered to the Great Western Ry. by Dixon in 1838. They must, therefore, be identical with the two Dixon engines, which according to a remark in Sir Daniel Gooch's Diaries (quoted in Vol. VI, 1901, Page 5 of the

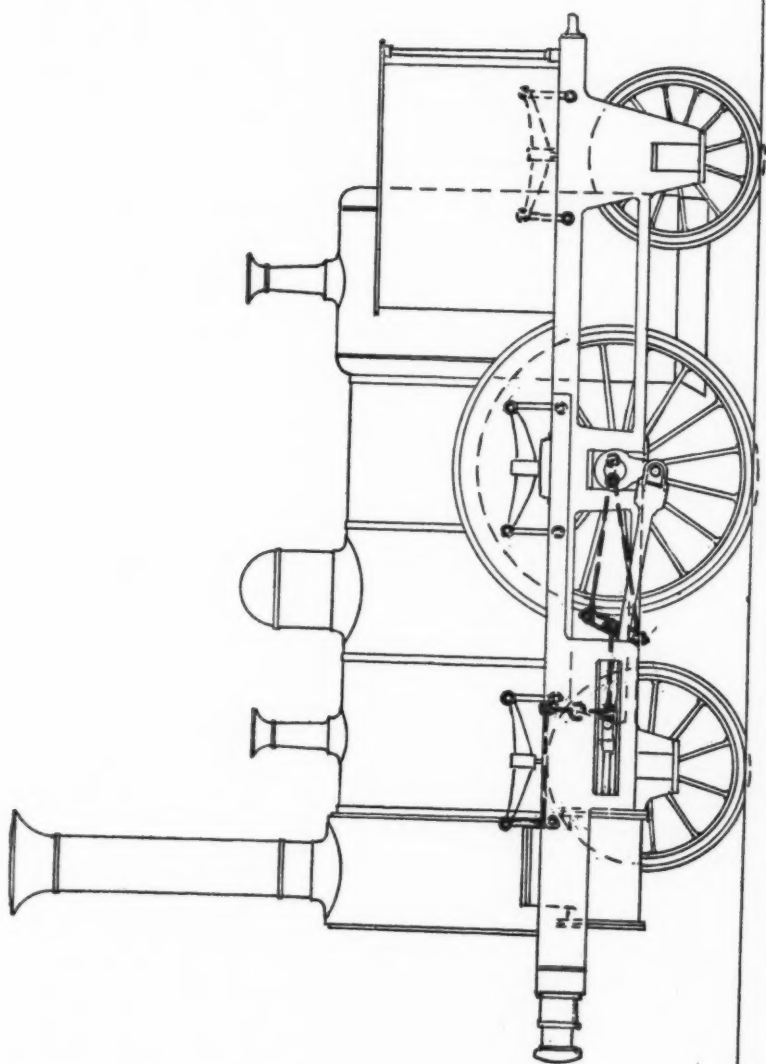


FIG. 1

Locomotive Magazine) came in as early as January, 1838. Now it is quite impossible that such engines should have had a haystack, or as E. L. Ahrons terms it, a 'Gothic' firebox, as shown in Fig. 13, page 44 of the Locomotive Magazine, 1901, since Robert Stephenson & Co. themselves, the originators of that type of firebox, brought it out only at the end of 1838. What the boiler mountings of a Dixon engine of about 1838 were like may be gathered from Fig. 14, page 45 of the same journal. There were two domes, one above the firebox and the other near the chimney, each with a spring balance safety valve. The same arrangement was retained even in 1839 as will be seen from Fig. 32, page 36 in Ahron's "British Steam Locomotives."

For the same reason the haystack dome which appears in the restored Liverpool & Manchester Ry. locomotive "Lion" (see photo. in The Locomotive, September, 1930) is an anachronism; it is, moreover, refuted by a specification for new boilers for the Liverpool & Manchester Ry., dated Manchester, October 24th, 1838, and signed Edward Woods (published in The Engineer, June 15, 1883). Boilers were then made of four or more plates of equal breadth, each plate the whole length of the boiler, a practice followed by Stephenson & Co. still in 1843. (see their 0-6-0 long-boiler engine, Warren, page 352, also the "Sulza", Stephenson No. 522, delivered to the Thuringische E. B. in 1848.) This 2-4-0 type long boiler engine exploded Nov. 30, 1863 and the boiler, describing the accident in the "Organ" was composed of six longitudinal plates, each 13 feet in length. The boiler of the "Lion", as shown on page 96 of Marshall's book, consists of three rings, the middle of which is the largest in diameter, but neither this boiler barrel nor the mighty firebox annexed to it can be the original ones, the specification quoted above strictly opposing such a supposition in referring definitely to the Lion and Tiger class of locomotives. It is also to be noted that the strongly raised half-round-topped firebox-shell is a yet later device than the haystack and that it often was chosen to replace an anterior haystack since it was much safer and offered equal steam space. This consideration may have induced the Crewe men to hide the "Lion's" existing firebox shell in a quadrilateral cupola of enormous size. In my opinion there was never a haystack on the Liverpool & Manchester Ry., and, I think, they did not get the worst of it.

An article giving a record of the whole locomotive work done by Mather, Dixon & Co., appeared in The Engineer, April 14th, 1899, page 358. This article appears to have escaped the attention of Mr. Marshall for it mentions a locomotive engine which must be reckoned among "The First Hundred", but which is not mentioned in Marshall's essay. It is the firm's No. 1, a small 0-4-0 engine with 3'-0" wheels built in February, 1827 for their own use. We also become acquainted with the "Wigan", a 2-2-0 type of locomotive, Dixon's No. 22, delivered in 1836 to the Parkside & Wigan, later North Union Ry. We learn that the builders' number of the "Dart" of the Liverpool & Manchester Ry., left blank in Marshall's list, page 76, is 34. We find that the "Mars", one of the six engines delivered by this firm to the Great Western Ry., (see The Locomotive, Vol. VI, page 44) is not mentioned in the article by name, but we may easily discover the engine in the one 2-2-2 built in 1836 for stock besides an 0-4-2, an 0-6-0 and two 2-4-0's (Nos. 27-31); as

the engine certainly was not constructed as a 10-footer, we must once more charge Mr. Brunel with the responsibility of having instigated the alteration (see also Ahrons in "British Steam Locomotives", page 45). The two engines, "Salamander" and "Phoenix", put to work on the Holland Ry. in March, 1843, and qualified in the records of the railway as Sharp Robert's pattern i.e. having a short boiler with slightly raised firebox, must be hidden in Dixon's Nos. 78-83, built in 1842 for stock. The builder's Nos. 2 and 3 for these two locomotives, as given in the records, cannot be correct. (See The Locomotive, 1927, page 1361). And finally, it is of interest that in the extensive demand for locomotive boilers as shown by the Liverpool & Manchester Ry. from 1838 onward and by the Grand Junction Ry. about 1842, Dixon & Co. secured orders for twenty boilers, ten from each railway.

In taking the preceding notes from The Engineer's article we have assumed their reliability although there are some items which seem to be incompatible with certain facts hitherto considered as known. For example, the construction, as early as 1836, of 2-4-0 engines by another firm than Stephenson & Co., or the discrepancy in the Dixon numbers of a lot of three North Midland Ry. engines which in The Engineer are given as 57-59 and by Whishaw as 31-33. I am inclined to accept the judgment of Dendy Marshall (Two Essays, pages 44 and 93) that the writer of the article 'Locomotives supplied by British Firms to American Firms to American Railroads', published in four parts in The Engineer, 1898, Jan. 21st to March 18th,—and the writer of the Dixon article is no doubt the same—though by no means wholly trustworthy, yet is not far from the truth. The agreement of most of his dates with those given by Wood and Whishaw cannot be considered a proof of his reliability as he *has* consulted those two authorities and even goes so far as to doubt their trustworthiness, in some cases. On the other hand, he may have disposed of some documents which have since disappeared or had some personal information unknown to us so that the part he filled up with his own fancy may be considerably smaller than it appears nowadays. That he was well acquainted with Document No. 51 of the United States Congress of 1839 is proved by the fact of his knowing all the names of the Bury engines sent to America which elsewhere does not appear. His statement of two engines, (Stephenson Nos. 151 and 152) being contracted for the Baltimore & Susquehanna R. R. through the agency of G & A Ralston is now confirmed by Warren's book, page 360. This leads to the conclusion that he must have had access to the Stephenson archives either personally or through an intermediary. The same conclusion can be drawn from what he says about Stephenson's second engine for America and which well agrees with Warren's statement so far as type of engine, date of construction and the intervention of Captain Whistler are concerned (Warren, Page 152). Mr. Herbert T. Walker whose fine article on 'Old Braithwaite Engines in America' which appeared in The Engineer, April 22nd, 1898, page 376, only a few weeks after 'The Locomotives by British Firms . . .', was, no doubt, one of his informers and well qualified too. On the other hand, there appears to be a certain amount of invention particularly in what he states about the early locomotives supplied by Bury & Co. He makes Bury's No. 2, the "Liverpool", in his haste to begin locomotive

building in January, 1831, completed in March, then tried on the Liverpool & Manchester Ry. then sold to an Agent of the Petersburg R. R., U. S. A., on which line it was put to work in May of the same year. See for comparison the well documented statements in the book of Warren, pages 245 and 256, and of Marshall's "Two Essays", pages 67-70; "Liverpool & Manchester Ry." Pages 103-105 and 115-116. Moreover, the builders' numbers and dimensions he gives of Bury's American engines do in no way correspond to a list of the Clarence Foundry's ie. Bury's Nos. 2-19, published in *The Engineer*, 1857 for Sept. 18th. This old document notes correctly the 6 ft. wheels of No. 2 which size seemed for a long time vanished from the memory of mankind. Unfortunately, the names of the engines and the purchasers are lacking, but Nos. 3 and 4 correspond well to the "Liver" and "Peel" as known from Wood and Wishaw. Nos. 6 and 7 appear to conceal the "Veteran" and the "Clarence" of the Bolton & Leigh Ry., whereas most of the other numbers, viz. 5, 8-14, 18 and 19 were rather small engines with cylinders of 8 to 10 by 16 inches and total heating surfaces of 150 to 251 sq. ft., thus being well suited to the requirements of a light track as was then general in the United States.

The following in regard to the Whistler affair will, after all, give an idea how the writer of the articles may have proceeded in a given case. From Stephenson's books he could not learn for which railway the engine was destined, but he found in the U. S. A. Document No. 51, 1839, a locomotive named "Whistler" built by Stephenson & Co. for the Boston & Providence R. R. and dated 1833. Not being aware that the Boston & Providence R. R. was not incorporated until 1831 (see Bulletin 20, page 38), he identified the "Whistler" of 1833 with the engine ordered by Captain Whistler in 1829, interpreting the year 1833 as the date of changing the name from "America" to "Whistler". There is, at the outset, but little probability that such an obsolete engine could have lasted until 1838-9 and there can be no doubt but the engine dated 1833 was a new one, having a multitubular boiler. According to a letter published in Bulletin 4, p. 45, Mr. P. T. Jackson, treasurer of the Locks & Canals Co., imported in 1832 two locomotives of Stephenson's manufacture, one of about 10, the other 8 ton weight. Owing to a longer delay in opening the Boston & Lowell R. R., for which they were intended, he sold the smaller engine to the Boston & Providence R. R. on which it was still running on February 9, 1839, date of the letter. This latter engine cannot but be identical with the Whistler, B. & Pr. R. R., as given in the U. S. A. document. The year 1833 would be that of buying the engine from Mr. Jackson, and the engine would have been built in 1832 or 1831. As Mr. Jackson praises it as fully equal, if not superior to any one running on the B. & Pr. R. R. in 1839, it must have been constructed on the most advanced Stephenson pattern, i.e. that of the Planet.

As to the illustrations, it is only fair to admit that the writer, whenever he asserts to give exact copies of the original working drawings, does so, and save for the fact that he liked to elaborate them to full external elevations. Otherwise he is not very scrupulous, illustrating for example Stephenson's 2-2-0 Planet type engine "Delaware" of 1831

simply by the incomplete sketch which Pambour, during his first visit to the Liverpool & Manchester Ry., in July and August, 1834, made from a Liverpool & Manchester Ry. engine and which we have commented upon at the beginning of our essay.

In reply to the imputation of doubtful reliability addressed against Wood and Whishaw in regard to the locomotive lists published by these two authors, while there are some errors in such large masses of figures, as Whishaw admits himself, but never have the two authors attempted to pass their own combinations for matter of fact. If no dates were available, blanks are left, save where Whishaw appears to have invariably taken the lengths of tubes 6" longer than the length of the boiler in such cases where this dimension was not at hand. Wood gives only the length of the boiler and in some cases this appears to have been the length of the tubes. This is especially manifest in Wood's Hawthorn list. While the great mass of data was furnished by the locomotive builders or the railway companies, the errors are essentially those of the said authorities, except in such cases where errors might have crept in in grouping the material, particularly in the case of the foreign railways. From the latter, no direct contributions appear to have been available, whereas several of the English railways such as the Liverpool & Manchester and the Grand Junction roads, let him have their complete locomotive lists.

The following corrections to Whishaw's list of English locomotives built for German railways, based on old official German documents, may elucidate such lacks or errors and their real nature is shown.

1. Berlin & Potsdam Ry. Besides the six Stephenson engines, those with builder's numbers 185, 186 and 197 bore the names "Pegasus", "Iris" and "Hercules" respectively, there was one engine named "Jupiter", built by Longridge and received in 1839, builder's No. 106, and four engines by Tayleur. These last four Whishaw inadvertently credits to the Berlin & Saxony Ry., and while the names quoted are correct the "Rocket" should be replaced by "Greif". The "Jupiter" was a classic 0-4-2, inside cylinders, 14x18" and 5'-0" driving wheels. It had a somewhat checkered career as may be gathered from 'Hanomag-Nachrichten', 1921, page 189.

2. Berlin & Saxony Ry. The name of the railway here is quite correct for the time of contracting for the locomotives (March, 1837), but before delivery in 1838, the name was changed to Berlin & Anhalt Ry. because the Prussian government charged the company not to join with the Leipzig & Dresden Ry. at Riesa in the Kingdom of Saxony, but to join the Magdeburg & Leipzig Ry. at Coethen in the Duchy of Anhalt. The four 2-2-2 Stephenson locomotives mentioned by Whishaw, were followed in 1840 and 1841 by eleven others. Seven were built by Stephenson, Nos. 254, 290-295 of the 2-2-2 type and the four other Stephenson engines, Nos. 280-283, were of the 0-4-2 pattern. It is plain that Whishaw, at the time his book was going to press, could not know of these engines.

3. Leipzig & Dresden Ry. Besides the eleven engines named in Whishaw's book, there were five engines built by W. Kirtley & Co., Warrington, in 1837 and 1838 and four from Bury & Co., Liverpool, built in 1838. The Kirtley engines—"Renner", "Sturm", "Elephant",

"William Kirtley" and "Greif"—were of the 2-2-2 type and the Bury engines—"Edward Bury", "Drache", "Adler" and "Pfeil"—were of this firm's well-known 0-4-0 type.

4. Magdeburg & Leipzig Ry. Altogether eighteen locomotives of the 2-2-2 type were supplied this railway by Sharp, Roberts & Co., the delivery of which extended from 1839 to 1842. The "Mercer" in Whishaw's list is a misprint for "Mercur" (Mercury).

5. Munich & Augsburg Ry. At the end of 1838 six engines had arrived at Munich. The "Jupiter" and "Juno", according to Wood and Whishaw, came from Stephenson and were Nos. 157 and 158. The "Vesta" and "Venus" came from Sharp, Roberts Co. and the "Vulcan" and "Mars" came from Fenton, Murray & Jackson. In 1841 two more engines, the "Merkur" and "Diana" came from Stephenson's. All of these engines were of the 2-2-2 Patentee type, but otherwise showed special features of their builders. In July, 1856, these eight engines were exhibited for sale by the Royal Bavarian State Railways, which had, in October, 1844, absorbed the M & A Ry. On this occasion, 1856, a table of the main dimensions of these engines was published, wherefrom I quote those referring to the first four, for comparison with the data given by Whishaw.

"Jupiter" and "Juno": cyl. $11\frac{1}{2} \times 16$ ", boiler $3'-1" \times 8'$, 100 tubes— $1\frac{1}{2} \times 8'-6"$, firebox $2'-5\frac{3}{8}"$ long by $3'-5"$ wide by $3'-5\frac{1}{2}"$ high in all, driving wheels $4'-11"$

Sharp & Co. One engine $11\frac{1}{2} \times 16$ " cyl., boiler $3' \times 7' \times 4\frac{1}{2}"$, 103 tubes— $1\frac{1}{2} \times 7' \times 9"$, firebox $1'-11" \times 3'-4" \times 3'-7"$, driving wheels $4'-11\frac{1}{2}"$

Sharp & Co. The other engine, cyl. $12\frac{3}{4} \times 16$ ", boiler $2'-11\frac{1}{2} \times 8'-8"$, 117 tubes— $1\frac{1}{2} \times 9'1\frac{1}{2}"$, firebox $2'-3\frac{1}{2} \times 3'-4\frac{5}{8} \times 3'7"$, driving wheels $5'-0\frac{1}{2}"$

The dimensions of the two Stephenson engines coincide with those given by Whishaw considering that it is usual in Germany to note the diameters of the boiler and tubes as well as the length and width of the firebox *inside* and that the height of the firebox is, in the German document, definitely taken *in all*, whereas Whishaw notes it above the grate bars.

As for the Sharp engines, it appears from the records of the M & A Ry. that they were, as originally built, similar to each other, having cylinders $11\frac{1}{2}"$ diameter. It will be noted in the above table that only one of the engines agrees with this figure and that its boiler has the usual proportions of 1838. There cannot be any doubt but that it represents the engine as originally built whereas the other engine must have been reboilered and fitted with new cylinders some time prior to 1856. The two Sharp engines in Whishaw's list are quite different from those in our table, since they are recorded as being built in 1839 with cyl. 12×18 ", driving wheels $5'-6"$ and boilers of $3'-3" \times 8'-4"$ (length of tubes). We must conclude, therefore, that Whishaw is at fault with his data on these two engines. He appears to have confounded them with the two immediately preceding ones of the Muelhausen & Thann Ry. to which he attributes exactly the same names—"Venus" and "Juno"—the same date of building and the same dimensions save for a slight difference in the length of tubes without, however, affecting the heating

surface. The M & Th Ry. had, in fact, two Sharp engines with 12x18" cylinders and 5'-6" drivers, but were called "Manchester" and "Albion" and one with 11x16" cylinders and 5'-0" drivers, (like Whishaw's 'Minerva') which was named "Liverpool". No six wheel four coupled engine can be traced on the M & Th Ry. though Whishaw records one without a name. The dimensions of this latter engine agree almost exactly with those of three supplied to the Manchester & Leeds Ry., see Whishaw's list of locomotives for English railways, No. XVII.

6. Baden & Carlsruhe Ry. (Whishaw, foreign railways, No. III) This is a misunderstanding for Baden State Ry., the first line of which was from Mannheim to Carlsruhe via Heidelberg. From the records of the Baden State Ry., which are the most complete ever published by a German railway, it appears that the "Loene", No. 1, was the engine with 99 tubes and that the "Greif", No. 2 the one with 133, not 132 tubes as stated by Whishaw. From June, 1841 to March, 1843, four more engines of the same general type from Sharp's, were put to work, viz. Nos. 3-6, named "Heidelberg", "Mannheim", "Roberts" and "Freiburg".

7. Taunus Ry. (Frankfurt to Wiesbaden). This railway had eight 2-2-2 type engines supplied by Stephenson, their numbers and dates were as follows:

	Put to Work	Cyl.	Drivers	No. of Tubes	Builders # Whishaw
# 1 Blitz	1839	12x18"	6'-0"	80	—
2 Pfeil	1839	12x18"	6'-0"	80	250
3 Adler	1839	12x18"	6'-0"	80	249
4 Wiesbaden	1840	12x18"	6'-0"	80	255
5 Stephenson	1840	12x18"	6'-0"	80	—
6 Gutenberg	1840	12x18"	6'-0"	86	206
7 Frankfurt	1841	13x18"	5'-6"	103	—
8 Mainz	1841	13x18"	5'-6"	103	—

The date 1840 in Whishaw's list appears to be shifted by one line, applying only to No. 255. Whishaw's date, 1839 for No. 206, which engine did not commence working on the T Ry., before May, 1840, joined to the fact that the "Gutenberg" almost immediately had to undergo heavy repairs to its firebox, seems to indicate that it had seen service elsewhere.

8. The title 'Vienna Ry.' (Whishaw's foreign list, No. XV) comprises two distinct railway companies—the Kaiser Ferdinands Nordbahn (from Vienna to the North) and the Vienna & Gloggnitz Ry. (from Vienna to the south) To the former belonged the first eleven engines in Whishaw's list, those coming from Stephenson: were named "Austria", "Moravia", "Vindobona", "Vulcan", "Jupiter", "Gigant", "Concordia" and "Bruna". This road received in 1839 the "Rakete" from Turner & Evans; the "Magnet" from Longridge, builder's No. 118 and the "Nordstern" from J. Rennie. Turner & Evans supplied two more engines in 1840, four in 1841 and four more in 1842. Sharp sent four in 1841 and Nasmyth & Gaskell sent two in 1842. Hawthorn's engine "Moedling", not "Modling" for the Vienna & Gloggnitz Ry. carried builder's number 261, not 2. The two Sharp engines for the same rail-

way were followed by eight more from the same firm. The Stephenson engines, six in all, comprised the "Dornau", "Gloggnitz", "Reichenau", "Guttenstein", "Raab" and "Rauenstein"—builder's Nos. 221-226 respectively.

No mention is made by Whishaw of the following German railways which possessed English locomotives at the beginning of 1840.

1. Nuremberg & Fuerth Lewis Ry. (so called in honor of the then King of Bavaria, Lewis I.) This railway, the first in Germany, had two small 2-2-2 engines built by Stephenson, builder's No. 118 (of 1835) and 148 (of 1836), which were given the names "Adler" and "Pfeil" respectively. They are to be found in Wood under the somewhat curtailed heading of Nuremberg and Lewis Ry.

2. Brunswick State Ry. In 1840, there were three engines of Forrester, Liverpool, two of which were built in 1838—the "Advance" and "Swift"—while the third, the "Dart", came in 1840. The English names on a German railway are noteworthy. In November, 1843, two more engines were received from Forrester—the "Blankenburg" and "Magdeburg". The low price of these engines, £853 each without tender, suggests that they were acquired second-hand. All five were of the well known 2-2-2 Forrester type, outside cylinders and with outside frames. Whether they all had originally the firm's valve gear with vertical eccentric rods is not known though this is assumed for the first two engines. The dimensions of the cylinders and drivers were as follows: "Advance" and "Swift"—11x18" 4'-9" drivers, "Dart"—13x18" and 5'-0" drivers and the last two had 13x18" and 5'-6" drivers.

The accompanying illustration, Fig. I, prepared from a sketch by Herr Geh. Baurat Kelbe at Brunswick and forwarded to me by Herr W. Nolte, Hannover, shows one of the Brunswick Forrester engines in the state after it had been fitted with the Stephenson valve gear. As the wheels, from front to back, appear to be 3'-6", 5'-0" and 3'-0" in diameter, the sketch must represent the "Dart" of 1840. The difference in size of the leading and trailing wheels, the placing of the cylinders between the outer and inner frames and the four (not two) slide bars for the crosshead agree wholly with Mr. Alexander Allan's statements as mentioned in Ahrons' 'British Steam Locomotives'—page 30. The same authority, Mr. Allan, asserts that none of the Forrester's outside framed engines, with outside cylinders, were built for a British railway after 1840, and as the Brunswick Ry. engines "Blankenburg" and "Magdeburg" were, in all probability, bought from an English railway, they must have been built in 1840 at the latest. They may be identical with two of four built for the Birmingham & Gloucester Ry. in 1838 (Ahrons), in which case Whishaw's figure of 4'-0" for the front wheels would be incorrect, or with the Grand Junction Railway's Nos. 63 and 64—"Herod" and "Odin"—built in 1840.

3. Rhenish Railway—(Cologne—Aachen—Belgian frontier). The first locomotives were three built by Longridge named "Atlas", "Pluto" and "Phoenix". They entered service in May, 1839. The "Atlas" was an 0-4-2 freight engine and the two others were 2-2-2 passenger engines.

From the above it would seem that the locomotive builders Bury; Fenton, Murray & Jackson; W. Kirtley and Longridge, did not favor Mr. Francis Whishaw with the dates of the construction of their loco-

motives. Of these, Kirtley is absolutely missing in Whishaw's lists; the other three appear now and then, but in such cases the dates apparently do not come from the builders. Of course it makes a difference whether they are supplied by the railway companies or by the builders. That the latter give the date of construction, the former the date the engine entered service, is of little importance, the difference rarely exceeding one year. But as to dimensions, the builder gives them from the engine as built by him, the railway company such as they were at a given time, i. e. at the end of 1839 as regards Whishaw's book. For we must suppose that the railway companies provided they were willing to conform to Whishaw's request would send in their last state of locomotive stock. Now it is a well known fact that the earlier engines, especially those of the L. & M. Ry. underwent very frequent repairs and alterations, which modified considerably their dimensions as originally built. It is interesting to observe that already Wood, in his enumeration of the first thirty-one engines of the L. & M. Ry. notes some few of them with dimensions differing from the original ones. Whishaw, in order to avoid any confusion, gives two separate L & M. locomotive lists, the one comprehending twenty-nine of the first thirty-two engines as originally built—the three missing ones being those built by Fenton, Murray & Jackson—and the other quoting all the engines in service at the end of 1839 with the dimensions they had at that time. We learn from the latter list that in 1839 the engines Nos. 1 to 8, 10, 12 to 18, 20, 24 to 26, 28 and 32 were not existing in the books of the L. & M. Ry. Co. Several engines—9 Planet, 11 Mercury, 22 Victory, 23 Atlas, 27 Pluto, 29 Ajax, and 31 Firefly—figure in both lists, but with more or less differing dimensions as they had been rebuilt in the meantime. A comparison of the two lists shows clearly the tendency of replacing the small leading wheels of the earlier engines—Nos. 9, 11, 19, 21, 22 and 30, with larger ones of 3'-6" diameter instead of the original ones of 2'-8" and 3'-0". It shows also of reducing the number of tubes in the new boilers and the nominal heating surface and of adding a pair of trailing wheels behind the firebox in the 2-2-0 and 0-4-0 type of engines in order to support the lengthened firebox. This is shown in the "Atlas", No. 23—0-4-2 and the "Pluto", No. 27—2-2-2 type. From Whishaw's older list of the Liverpool & Manchester Ry. engines, it would appear that the data covering these locomotives as built by Stephenson & Co., and which was regretted by Warren in 1925, was already missing in 1840. According to Wood it was lacking even in 1838 as the blanks indicate in the engines "Meteor", "Comet", "Dart", "Phoenix" and "North Star". The fireboxes of the first seven engines of the Liverpool & Manchester Ry. ("Rocket" to "North Star" incl.) were set on, and not enclosed with the boilers and had no front water spaces, the boiler barrel back plate and the firebox tube plate being the same. As the result, there was no difference between the length of the boiler and the length of the tubes in those engines. Nevertheless, Whishaw notes his usual difference of 6" in the "Rocket" as well as in the "Phoenix" and "North Star", whereas he appears to be on the right track as regards Nos. 2 to 5 ("Meteor" to "Dart"). In the same list, he erroneously gives the "Atlas" and the "Milo", which were originally 0-4-0's, as 0-4-2's, in contradiction to Wood.

In terminating our arguments on the subject of reliability, we must apologize for having so long engaged the patience of the readers of this Bulletin. This investigation was indispensable since most of our statements must stand or fall with the authenticity of the dates of the said authorities. Since there was no motive of personal vanity for them to supplement matters by their own combinations, their sincerity in transmitting the dates to their readers which they had from the original sources, is to be presumed in all instances of our not being able to prove the contrary.

For example, I do not think that the late Mr. A. R. Bennett, in his excellent essay on the London & Greenwich Ry. has meted full justice to Whishaw's list, reproduced on page 27 of his book. He has omitted the column—"length to tubes"—(the misprint of 7.25 ft. for No. 1 instead of 8.25 ft. is easy to correct) and has added the two heating surfaces, giving only the sum, so that we cannot check the correctness of his figures. Moreover, he has changed the numbers of the last three engines giving them as Stephenson, No. 7 of 1838; Day, No. 8 of 1839 and Hawthorne, No. 9 of 1840. In Whishaw's original list they appear as Day, No. 7 of 1839; Hawthorne, No. 8 of 1840 and Stephenson, No. 9 of 1838. The reason was apparently to harmonize the numbers with the years. The list as published by Whishaw does not and cannot give the evolution of the London & Greenwich locomotive stock from 1835 or 1836 (opening year) down to 1840, but merely gives the situation as it was in 1840, when the railway company presented Whishaw their locomotive list which may have purposely been prepared for that author. In all probability Nos. 7 and 8 were built in 1837 and afterwards sold to another, possibly a foreign railway and these engines were replaced by a Day in 1839 and a Hawthorne in 1840. The correctness of Whishaw's numbering results from the fact that it allows the continuous numbering from London & Greenwich Nos. 1-4, 8-10, to London & South Eastern Nos. 127-133. According to Mr. Bennett's numbering, the new Nos. 131-133 would correspond to the old Nos. 9, 7 and 10 respectively without purporting a better order otherwise. That the list is the work of the railway company is evident from the completeness of the dates including the otherwise reserved firm of Forrester & Co., but except for the weights, the ascertainment of which the little railway appears to have been in want of the requisite expedients. I, also, wish to call the attention to the following item: the high figure, 61 to 71 inches of height of the firebox above the grate bars, (Whishaw), in this case can only be explained by being in reality the height of the *outer* firebox shell above the *bottom* and since it would be illogical to take the length and width of the firebox otherwise than the height, those dimensions must also be reckoned as 'outer firebox shell', and this is again corroborated by the corresponding figures.

In this connection, I cannot refrain from uttering my opinion about Mr. A. R. Bennett's illustrations of the first nine engines of the London & Greenwich Ry. He is undoubtedly right in supposing that his Figures 25 and 26 exemplify only *two* types of engines. Mr. Warren has now ascertained (page 254 of his Centenary book) that Mr. Bennett's Fig. 25 was first published in 1831, five years before the opening of the London & Greenwich Ry. Fig. 27 is an unmistakable Hawthorne as may

be gathered from a comparison with Whishaw's Plate 5 (Hawthorne's No. 245) or with the 'Appendix to Railway Practice' by S. C. Brees, 1839, where fine drawings of Hawthorne's No. 244 are to be found. Fig. 28 is a typical Stephenson engine of the period; two safety valve columns are to be imagined on the barrel behind the steam dome like the two engines on page 324 of Warren's book. The wood-cut showing the Greenwich Ry. in 1837 (Mr. Bennett's Fig. 1), offers a 2-2-0 Planet type of engines having the same boiler mountings. It would be interesting to learn if Messrs. Stephenson & Co., built in 1837, one or two other 2-2-0 Planets other than the "Moravia" as noted above.

The most brilliant and reliable parts in Whishaw's list are those coming from Stephenson & Co. and their branch establishment, Charles Tayleur & Co. It would be difficult to prove any serious error in the dimensions of a Stephenson or Tayleur engine as listed by Whishaw, particularly if built from about 1833 onwards. Relying upon this fact, we shall now attempt to prove conclusively that the "Elephant" of the Belgian State Ry. was not the first 2-4-0 engine ever built, but that this type of engine was not created until two or three years after the "Elephant" had been constructed.

The first mentioned of "L'Elephant" is made in "Travaux Publics en Belgique, 1830-1839. Chemins de fer et routes ordinaires. Rapport presente aux chambres legislatives, le 12 novembre 1839, par M. Nothomb." According to this document, "L'Elephant", No. 2, was built by R. Stephenson & Co. as their No. 100, had cylinders 14" in diameter, driving wheels 54" in diameter and commenced working in the construction of the line in Feb. 1835. In Whishaw, we find the same engine as built by Tayleur & Co., in 1834 and as being of the six-wheel four coupled type with 4'-6" drivers and 14x18" cylinders. None of this data contradicts that of the Belgian document save the name of the builder. It was, however, a frequent practice of such a busy firm as Stephenson's to transfer a part of the orders to an allied firm and to even provide a Stephenson name plate for such engines, with the serial number stamped thereon. This latter was in such cases when the customer attached some value to the engine being built by this or another renowned firm. From a list of the several contracts concluded by the Belgian Government for the supply of locomotives, it appears that no contract was made with Tayleur & Co. "L'Elephant" as well as two 2-2-2 engines—"La Fleche", No. 1, builder's No. 88 and "Stephenson", No. 3, builder's No. 89—were contracted for with Stephenson & Co. on May 2nd, 1834. According to the annual returns of the Belgian State Rys., "L'Elephant" was condemned to be demolished on Feb. 4, 1847, the first engine to be thusly treated, but in 1850 was 'again erected by means of a new boiler' with cylinders of 15" diameter and in this condition it lasted until 1865 when it was finally scrapped.

All indication—the year constructed, the dimensions given by Whishaw and which coincide almost exactly with those of some engines built by Stephenson and Tayleur in 1834 and 1835 for the Stanhope & Tyne Ry. (for illustrations see Warren page 310 and 315) and the short career of the engine, seem to indicate that "L'Elephant", as originally built was an 0-4-2 engine with slide bars below the leading coupled axle. On the other hand there is a well known model of "L'Elephant", show-

ing the 2-4-0 wheel arrangement with inside horizontal cylinders. Photographs of this model are to be found in *The Locomotive*, 1905, page 214 and 1913, page 210, while a drawing of "L'Elephant", as a 2-4-0 engine, has been published by the late A. R. Bennett in 'Railways & Tramways', Jan. 1, 1908, page 8. The drawing differs from the model in showing the third axle below the end of the firebox instead of behind it, as in the model. Nevertheless, in both instances, the Belgian Railway officials assured that "L'Elephant", in its original condition, was on view. There are also considerable difference as to dimensions. On the table affixed to the model one could read (at one of the pre-war exhibitions) cyl. 14x22"; wheels 5'-0" and 3'-2", diameter of boiler (average) 3'-5", number of tubes 137, total heating surface 665 sq. ft., while Mr. Bennett gives in the same order: 14. 9x21. 6", 4'-8" and 3. 18 ft. 3. 41 ft., 137 and 622 sq.ft. None of these figures agree with those given by Whishaw and which must be considered as the only reliable ones for the original engine. Apparently, the genuine "Elephant" was a much smaller and weaker engine than the one represented by the model or drawing. Moreover, it must have been constructed strictly to Stephenson & Co's. drawings with all the characteristic features of this firm of about the second half of 1834: two loose eccentrics and hand gearing, forward dome, lock-up safety valve of peculiar form upon the exact middle of the barrel, ordinary safety valve in front of the firebox with oblique lever, the spring balance being fixed on the side of the firebox, manhole above the latter. Now both in the model and drawing, all the boiler mountings are on purely Belgian State Ry. lines as evolved at the beginning of the forties. The valve gear, as I convinced myself on the very model, was the gab motion with four fixed eccentrics arranged in the same manner as in the pseudo—"Harvey Combe", (Warren page 318).

If "L'Elephant" had been built as a 2-4-0 engine, it would be incomprehensible why this representative of an entirely new type of engine would not have been built by Stephenson & Co. themselves and why it should have remained in obscurity for such a long time. Moreover, it is very curious why the last of the Stephenson-built coupled engines for the Belgian State Rys., and the only one with 5'-0" driving wheels, Stephenson No. 217—B. S. Rys. No. 44, "Le Tonnerre", was of the 0-4-2 type; yet this must have been the case for the last named engine had, according to Whishaw, exactly the same dimensions throughout as Stephenson's Nos. 194 and 197—"Baer" and "Hercules"—for the Berlin & Potsdam Ry. which were of the 0-4-2 type.

The first 2-4-0 engine on the Belgian State Rys. appears to have been No. 133, "Leopold Ier", built by Cockerill, No. 89, and entered service on January 24th, 1843. The cylinders were 14x22" and the drivers were 5'-0". Fine drawings of this engine, which was one of the first *new* to have the Cabry expansion, are to be found in 'Bulletin du Musee de l'Industrie', Vol. II, Brussels, 1842, pages 17, 18 and 19. There is complete identity in the outward appearance with the model save that the sandbox is missing. The connecting rods of the model engine are 6 feet long while those of the supposed No. 133 are only 4'-6", i.e. as short as they were generally in all the earlier engines. This denotes that the engine from which the model was made was built later than January 1843. That the model represents exactly, the No. 2, as

rebuilt from 1847-1850, seems to be scarcely possible; for gab motion, even with the improvement of Cabry's device, is too antiquary for the end of the forties.

We sum up: firstly, the model does not and cannot represent "L'Elephant" as originally built; secondly, "L'Elephant" as originally built was of the 0-4-2 type; thirdly, the model represents, in general, one of a class of engines built from the beginning of 1843 until at least May, 1845, and perhaps some years longer, though from 1846 onwards, the 4-4-0 American type with small driving wheels (4'-0" to 4'-6") came into use for freight traffic. It represents one of the later engines of the class but is scarcely an exact replica of even the second or rebuilt "Elephant" and seems, rather, to be a compromise between the drawings as published in *Bulletin du Musee* and those, of evidently old official Belgian records, published in 'Railways & Tramways'. The latter seemed probably too modern to the designers of the model and in this they were not wrong. In our opinion, nothing authorizes us to question the reliability of the latter drawings which may fairly represent the rebuilt "Elephant" as the latest development of the Belgian 2-4-0 locomotive of the freight type.

In *The Locomotive*, 1925, page 393, a fine photograph of Belgian State Rys. No. 149, "General Evers", was published together with a sketch pretending to represent the same engine. The sketch is apparently derived from the old drawing of "L'Elephant" as published in 'Railways & Tramways' and somewhat adapted to the outward appearance of the "General Evers". It shows the smaller wheels and the supported firebox of the former and the oblique safety valve lever of the latter. The dimensions in the accompanying article have nothing to do with the "General Evers", but are those of "L'Elephant" as quoted above. The main dimensions of the "General Evers" were, according to a Belgian 'Cahier de charges pour la commande de locomotives' (reproduced in the German 'Eisenbahnzeitung', Stuttgart, 1845, No. 32) as follows: Cyl. 15x22", wheels 5'-0" and 3'-6", pressure 75 lbs. per sq. in., boiler (cylindrical part) 9'-6" long, number of tubes (brass) 151 of 1 1/4" O. D. From about 1865, this locomotive was used as a shunting (switching) engine and was scrapped in 1872.

It is worthy of note that in Whishaw's list the locomotives built by Rothwell and having circular fireboxes are well distinguishable from the others of the same firm by the width of the firebox being left blank, while the length is given. According to this Rothwell's Nos. 4—"Pioneer" and 5 (see Whishaw No. II—American Railways) had circular fireboxes. This is now corroborated by Ahron's Fig. 16, whereas Nos. 6, 7 and 8 were provided with ordinary rectangular fireboxes as shown on page 304 of Warren's book, where a photograph of the No. 6, presumably, is given (see letter to the Editor in *The Locomotive*, 1929, page 304). Of the Rothwell engines for the Leipzig & Dresden Ry., it is known that the 0-4-0's had circular fireboxes as denoted by Whishaw—there are some old engravings showing the "Faust" and others of the same type, and that the 2-2-2's had ordinary fireboxes is to be deduced from Whishaw's complete dates.

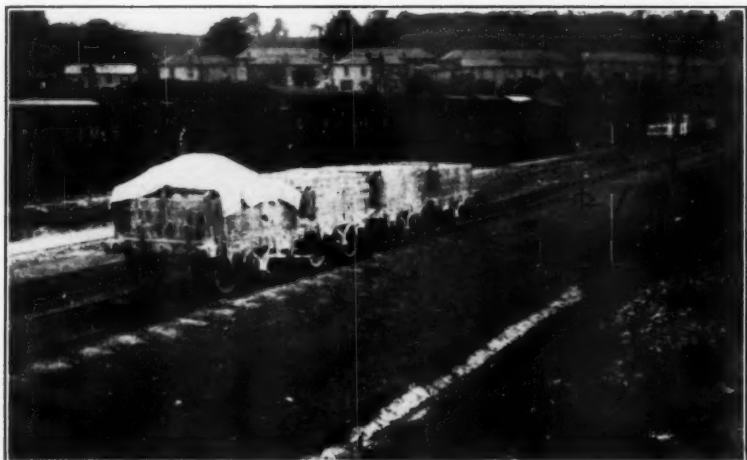
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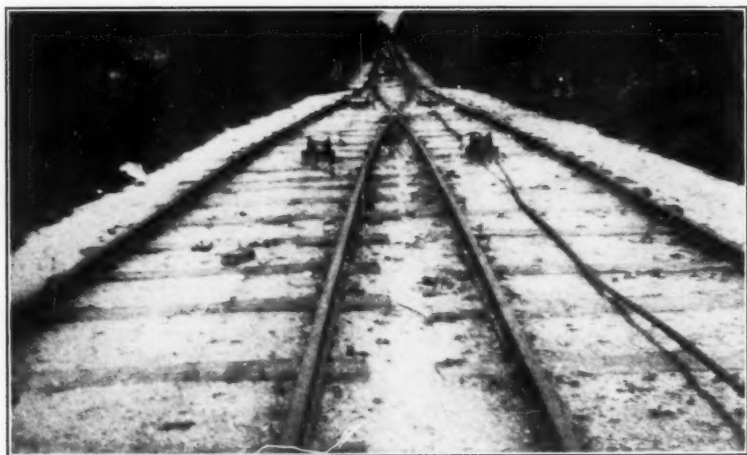
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Plymouth and Dartmoor Railway. Mineral Wagons at Laira, Plymouth.



Plymouth and Dartmoor Railway. Incline for China Clay Traffic.

Mineral Railways and Tramways in England

By G. W. BISHOP



OME notes headed "Early Tramroads in Great Britain", in Bulletin No. 20, attempted to describe certain early examples of transportation, which were the forerunners of modern railways. Closely allied to these are the "mineral lines" made for conveying coal, stone, or clay. These were frequent in early times, and still exist in some districts, especially Devon and Cornwall.

These present notes cannot profess to mention all mineral lines now existing, for they are so numerous that it would be very difficult to include them all in one article. Readers who are interested may find many lines of this character described and illustrated in "The Railway Magazine" and "The Locomotive". It is hoped, however, that the following examples will give some idea of the type of railway now under consideration.

The Plymouth and Dartmoor Railway was originally planned by Sir Thomas Tyrwhitt in 1818, and incorporated by an Act of July 2, 1819. Further Acts provided for an extension to Plymouth and a diversion through a tunnel 620 yards long. A ceremonial opening, with a procession, took place on Sep. 26, 1823, and soon after the line reached from Princetown to the coast at Plymouth, a single line with heavy grades, and the unusual gauge of 4 ft. 6 ins. The line appears to have been relaid with flat-bottomed rails, spiked to wooden ties, but there are traces of granite sleepers and cast iron fish-bellied rails having been formerly used. At Yelverton is a siding of stone tracks, somewhat similar to the "granite tramway" illustrated in Bulletin No. 20. Two of the few grade crossings of railway lines in Great Britain are found where the P. & D. Ry. crosses the Great Western Ry. on the level at Laira, and on the Tavistock line. These crossings date from the opening of South Devon Ry. lines in 1848 and 1859 respectively. On the Lee Moor section, which conveys china clay traffic, two 0-4-0 saddle tank engines are used, built by Peckett in 1899. Other portions are worked either by horses or gravity. For the photographs here reproduced, and for much of the information, we are indebted to Mr. B. Y. Williams, of Plymouth.

The Liskeard and Looe Ry. was opened for minerals in 1843, but passengers were carried as from 1879, and the line was leased to the G. W. Ry. in 1909, together with the neighboring Liskeard and Caradon Ry., opened 1846. Two 0-6-0 tank engines were taken over from the Liskeard & Looe line, named "Cheesewring" and "Lady Margaret".

The Cornwall Minerals Ry. was a comparatively large system, opened 1847, and having 18 locomotives of 0-6-0 side tank type, with 42 inch wheels and outside cylinders 16¼x20, built by Sharp. In 1877 the G. W. Ry. took over the line and locomotives, and built more engines of

similar pattern, but with saddle tanks. Some of the C. M. Ry. engines were sent to the Eastern and Midlands Ry. in 1881-2. The C. M. Ry. included a grade at I in 37, $2\frac{1}{2}$ miles long.

The Bodmin and Wadebridge Ry., previously mentioned in Bulletin No. 22, was originally made to convey sand from the Camel River for the use of farmers, and was probably the only railway ever built for such a purpose. Two locomotives named "Camel" and "Elephant" were built by Tregellas Price of Neath, who also built engines for a tramroad between Gloucester and Cheltenham. A company called the "Cornwall and Devon Central", which had no actual track, purchased the Bodmin line in 1845, which thus became absorbed in the London and South Western Ry., but had no rail connection with the latter system till 1895. The four passenger coaches are still preserved.

The Redruth and Chacewater Ry., opened in 1825, had a single line 10 miles long, with a gauge of 4 ft. Horse power was used till 1854, when three locomotives were employed, one being a 0-6-0 tank named "Spitfire". The line is now closed, but stone sleepers, weighbridge, and some buildings still remain.

Another line, known as "Treffry's Railway", reached Par Harbor, with an incline worked by a stationary engine, and also possessed a combined viaduct and aqueduct of granite. Several other lines in Cornwall may be found, worked by the G. W. Ry. A few canals exist, but are rare, owing to the hilly nature of the country.

Turning to tramways of the "street railway" type (see Bulletin No. 17) Mr. G. R. Reeves points out that horse tramways were opened by G. F. Train at Birkenhead in 1860, and at Bayswater, London, in 1861. These had the "step rail" introduced by Mr. Train, but the London lines thus fitted were eventually removed. Later systems had the usual flat grooved rail. Other London tramway dates are: Brixton to Kennington and White-chapel to Bow, 1876; North London (compressed air system) 1883; Highgate Hill (first cable trams in Europe) 1884; North London (first steam trams in London) 1885.

Early Railroads in Virginia



THROUGH the kindness of one of our members, H. E. Nichols, we are able to reproduce copies of some articles that appeared in the "Gazetteer of Virginia and the District of Columbia" for 1835, that relate to some of the early railroads in that section.

The article on Petersburg refers to the Petersburg R. R. and mentions the road had three engines, two of which came from Bury in England.

The article on the Portsmouth & Roanoke R. R., now a part of the Seaboard Air Line, states that it is under contract at that time but it is of interest to note the gauge is the same as our present standard—4 feet 8½ inches.

The article on Richmond, Virginia makes brief mention of the Chesterfield R. R., terminating on the Manchester side of the river, as being the first successful enterprize of the kind in the State of Virginia. It states it was planned and executed under the direction of Moncure Robinson, a distinguished engineer.

We are glad to have material of this nature sent us for reproduction purposes as copies of this early material afford a true picture of the facts as they then existed.

As the *Portsmouth and Roanoke Rail Road*, which is now under contract, is likely to exercise a very important influence upon the destinies of the whole section of country through which it will pass, we give a description of its location and plan of construction, from the report of its engineer, Walter Gwynn, Esq.

"The line which I have selected as the basis of my estimate, commences at the intersection of the western boundary of Portsmouth and the centre line of High Street, and proceeds over an extremely level and unbroken surface to an eligible site for crossing by a bridge, a branch of the Nansemond river, a few hundred yards north of the termination of the Dismal Swamp Land Company's Canal. Thence continuing the line to Suffolk several spring branches are crossed, requiring the construction of small stone drains and some heavy cuttings and fillings. After leaving Suffolk the character of the country changes and becomes somewhat bold—and in order to diminish the quantity of excavation and embankment several undulations in the plane of the Rail Road are unavoidably made—the inclinations are, however, gentle, and the line reaches Blackwater without encountering any other difficulties than an increased expenditure on this portion of it. From Blackwater a level is maintained for some distance, the line passes along the borders of the Swamps which make up to the Highlands, and crossing the Nottoway, on the lands of Mr. Rochelle about seven miles below Jerusalem, it ascends at the rate of 20 feet per mile, passing near Mr. Gurley's to the Cypress Bridge Road. Thence, leaving Vick's Chapel a little to the south making a slight undulation to avoid some filling, the line arrives at Capt. Barns' Quarter, on the summit of the ridge dividing the waters of the Nottoway

from those of the Meherrin. From Captain Barns' a descent is effected on a grade of 20 feet per mile to Buckhorn Run. Thence the line is continued, on a level, across the Meherrin, about a mile above Branch's Bridge. It then ascends, varying from an inclination of 20 to 12 feet per mile, until the *summit* of the Rail Road is attained, giving an elevation, above the level of tide water, of 144 feet.

"Descending from the summit, the Line crosses the Petersburg Rail Road, (On a level with that Road) about two hundred yards south of Capt. Garey's. It afterwards crosses the head of Raccoon Swamp, and terminates on the North bank of the Roanoke River, opposite Weldon. Its direction is S. 70 W., and its length 77 miles, being only half a mile longer than the distance on a direct line between Portsmouth and Weldon.

"The greatest inclination does not exceed 20 feet to the mile, and throughout the whole extent of the Road there are but few deviations from a straight line, and these are effected on the arcs of circles whose radii are in no instance less than 5730 feet, and are most generally 11,460 feet in length.

"Gentle inclinations and easy curvatures (when it is necessary to vary from a straight line) are points of essential importance in the location of Rail Roads—these desirable objects as well as a line extremely favorable to the advantageous employment of Locomotive Engines are here attained. Indeed, considering the straightness and the moderate ascents and descents, the performance of an Engine (*of given power*) will be greater on this, than on any other Rail Road now constructed in the United States. We are therefore enabled to use light Engines, thereby diminishing very considerably the great and leading items in the expense of transportation on Rail Roads, viz: *wear and tear and repairs*.

"The Engine which it is proposed to use will not exceed five tons weight, and its performance on this Road will be equal to that of a six ton Engine, on a Road with 30 feet grades. From this general view it will be seen, that the face of the country is eminently suitable to the proposed work. The intervening Swamps and the alluvial bottom lands of the Nottoway, Blackwater and Meherrin, offer no serious obstacles.—The bottom is everywhere composed of solid materials, affording a firm foundation for any embankment or other structure it may be necessary to place on it.

"*Construction of the Road.*—It will not be necessary on the present occasion to discuss the relative merits of the various modes of construction—and the variety of materials which have been used in the formation of Rail Ways. Suffice it to say, that the almost universal substitution of wood for stone, and the iron-edge-rail, establishes its preference in the first instance even where stone is abundant and timber scarce. Among the many reasons for this preference of wood, are—its elasticity, its sufficient stability, and its diminution of the *wear and tear* of engines and cars. It follows, then as a necessary consequence, that I recommend for your Rail Road the use of timber, which is found in abundance, of excellent quality on almost every part of the line.

"The superstructure, then, which I propose to adopt, will be heart pine rails, nine by five inches, plated with iron bars two inches wide, and

half an inch thick, resting on white or post oak sills, ten by twelve inches, and eight feet long, placed across the road, five feet apart from centre to centre. The rails will be placed parallel to each other four feet eight and a half inches apart, let into the sills and properly secured by white oak wedges. The sills will be notched for the reception of the rails and wedges and hollowed out in the middle, so as to admit of the construction of a path over them, which will add considerable stiffness to the road, at a very moderate expense—and adapt it to the use of either horse or locomotive power, or both.

"Width of Road Bed.—I have estimated for a single rail-way, which for the present will afford sufficient accomodation to the trade and travel. The ditches, however, will be cut and the waste earth disposed with a view to a double track, whenever it may be deemed necessary. The graduated surface of the road-bed in excavations, will vary from 18 to 16 feet in width, the slopes being 45°. The graded surface on embankments will present a uniform width of 12½ feet, with side slopes of 33-1/3° or 1½ base to 1 perpendicular.

"Between Suffolk and Spikes' Run we shall pass several small streams by means of stone-drains. The stone for this purpose can be readily obtained at Port Deposites, and the work done now, on as reasonable terms as at any other period. Farther on, wooden structures will be thrown over the water courses, with a span affording sufficient room for the erection hereafter of stone or brick culverts. The bridges across the Blackwater, Nottoway and Meherrin Rivers will be supported by abutments and piers of masonry, the stone for which can be transported by water from Norfolk to their respective sites, and will not at most exceed \$5 per perch (of 25 cubic feet) delivered. On approaching the Roanoke, rock is found tolerably convenient to the line, and will probably be used in crossing the Oconeechee, Troublefield, and Racecoon Swamp."—From *"Gazetteer of Virginia and the District of Columbia,"* dated 1835.

From Article on "Petersburg, Va."

Petersburg is now rapidly increasing in business in consequence of its *Rail Road*, to the Roanoke river, which is about sixty miles long, and affords an opening by which large quantities of produce are brought to this market from the upper Roanoke and from the interior of North Carolina, and by which goods are with much facility returned in exchange, as the cars run daily to the Roanoke and back again. The grade of the road, with the exception of two or three planes, with an ascent of twenty-seven or thirty feet per mile, is very favorable to the use of the locomotive engine; and their success with this kind of power has not been surpassed in the country. They have now three engines upon the road, a part of which have been at work upwards of nine months, and made their trips with as much regularity as could have been expected from horse power. One of those, the "Liverpool," is probably, for her weight, the most effective engine of the country. This, and one of the other engines on this road, were constructed by M. Bury, of Liverpool, who has also furnished two engines for one of the Schuylkill rail roads, which we are informed work equally well. The proprietors of this road

consider it as part of the great line of communication from north to south, and look to its ultimate connexion with the Charleston rail road, by similar works through North Carolina.—From "*Gazetteer of Virginia and the District of Columbia*" dated 1835.

Railroads, though but of late introduction into the United States, have attracted considerable attention in Virginia; one has been lately executed styled the *Chesterfield Railroad*, near Richmond. The results of this road are more brilliant in proportion to its extent, than those of any similar work in the Union. It is about 13 miles long, and connects the coal-mines of Chesterfield with tide-water. The whole capital invested in it, including cars for transportation, stables, horses, &c. was \$150,000. The trade on it already 50,000 tons per annum, and the receipts for transportation during the year 1833 were \$70,000. The stock is of course at a high premium.

The Petersburg and Roanoke Railroad was the second which went into operation in the state, which it did in mid-summer 1833; the cars running daily between its extreme points. This road commences at Petersburg, and extends 60 miles a little W. of S. to Weldon, in N. Carolina, and the foot of the falls of Roanoke river; the line is very direct, and the graduation in no place exceeds 30 feet per mile, and the curves have radii of from 2 to 4 miles. Great part of the profit arising from this road is derived from the transportation of persons. The work was begun on the line in 1831, and completed June, 1833, aggregate cost \$450,000. Before the construction of this road Norfolk had always been regarded as the proper depot and outlet for the trade of the Roanoke valley, and would no doubt have become possessed of it by improvements connected with her Dismal Swamp Canal; but this road having arrested most of the trade and carried it to Petersburg, the country about Norfolk procured at the session of 1833-4 the passage of an act authorizing the *Portsmouth and Roanoke Railroad*, which is to terminate at the same point on the Roanoke with the Petersburg road, and which is now under contract. The construction of the Portsmouth road will probably carry the trade to the seaboard, to avoid the tedious navigation of the James River, after it reaches Petersburg,—unless there should be a road made from Richmond to Petersburg, (which is spoken of) by which the trade coming by this route would have the advantage of the market of both cities. We can scarcely believe that there will be trade enough to employ profitably, both roads, as some suppose, but the travelling alone will always enable the Petersburg road to pay something to its owners.

The Winchester Railroad, connecting the flourishing town of Winchester with the Baltimore and Ohio railroad at Harper's Ferry, is rapidly progressing, and nearly completed.

The Richmond and Fredericksburg Railroad company have the law, and will probably soon have the funds necessary for its completion, as the trade would be considerable and the travelling immense.—From *Gazetteer of Virginia and District of Columbia*, 1835, by Joseph Martin.

Accident on the Montreal Ice Railway—1881

By ROBERT R. BROWN

SINCE the account of the Montreal Ice Railway appeared in BULLETIN 22, additional, and more reliable, newspaper files have come to light and, now, it is necessary to make a few corrections in the interests of historical accuracy. The accident was not due, directly, to weakness of the ice and the locomotive was not the "St. Pie", belonging to the South Eastern Railway. Some of the newspapers were violently opposed to the line, or rather to the promoter, Mr. Senecal, and the accounts of the accident, appearing in some of them, were rather sensational and unfavorable. The following notes have been taken from the files of the Montreal Gazette, a paper long known for accuracy and impartiality:

January 9th, 1881.

Yesterday afternoon intelligence reached the city of an accident on the ice railway, which opened for freight traffic yesterday morning. Rumor at first ascribed to the occurrence a far more serious nature than it possessed, and it was said that several lives had been lost, but happily this proved to be without foundation, as did also the sensational report published in an evening paper. The facts of the accident appear to have been as follows: "Shortly after four o'clock, yard engine No. 31, the 'C. A. Scott', belonging to the Quebec, Montreal, Ottawa and Occidental Railway, having on board Messrs. Senecal, Jr., E. Fortin, with the engineer, fireman and another, started from the Hochelaga side to fetch a train of seventeen cars from the Longueuil wharf. When about a couple of hundred yards off the wharf, the engine, possibly from a deflection of one side of the line, jumped the track, and, turning over on the ice, broke through and sank in thirty feet of water, where it now lies. The occupants saved themselves by jumping off and none were injured. Almost immediately afterwards, the work of repairing the track was commenced and by noon to-day it is expected the road will be in running order again. The engine will be raised at once, the company having already received a number of offers to undertake the work.

January 12th, 1881.

The trains across the river drawn by the small engine, "Calumet", commenced running again on Saturday morning. Mr. Larin will begin the work of raising the sunken locomotive on Monday.

January 19th, 1881.

The work of raising the submerged engine in the river is progressing favorably. Yesterday a large derrick was hauled to the opening in the

ice, and, by use of chains and a windlass, it is hoped to raise the engine to the surface. Water is being thrown around the hole to strengthen the ice.

January 26th, 1881.

The engine "C. A. Scott" was raised up out of the water yesterday, the 25th. The damage done to it does not appear to be very serious, as whilst the lighter parts are a good deal broken and bent, the body, wheels etc., are apparently not much the worse. The branch line to the spot is now completed and the engine will be in the workshop to-morrow.

The "Loco Cranks"

(By One of Them !)

Of all the fads beneath the Sun
That to our lives gives zest
The "Engine Fad", it is the one
That I do like the best.

A "Loco Crank" I often find
When wandering from home,
They hail me as of "kindred mind"
From Bowdoinham to Rome.

They're found in many walks of life
Some young, some old and gray
Some bachelors, some with a wife
To cheer them on their way.

Of builders, they a study make.
They known 'em by their looks!
Can tell you, when a glance they take
If Baldwin's, or if Brooks'.

For photos they hunt day and night
They're filled with engine lore
Of driving wheels can tell the height
Of cylinders the bore.

All Hail the wood-burner of yore
Gay with red paint and brass!
We used to run a mile or more
Just for to see her pass!

From mammoth stack trailed smoke clouds dense
And showers of sparks by night.
Around her ran an iron fence
From cab to dim head-light.

Hurrah then for the "Loco Cranks"!
They sure are the real stuff.
May no dissensions thin their ranks
'Til engines cease to puff.

"UNCLE JIM KIMBALL".

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